AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 10, No. 23 WEEKLY. | NEW YORK, JUNE 4, 1887. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

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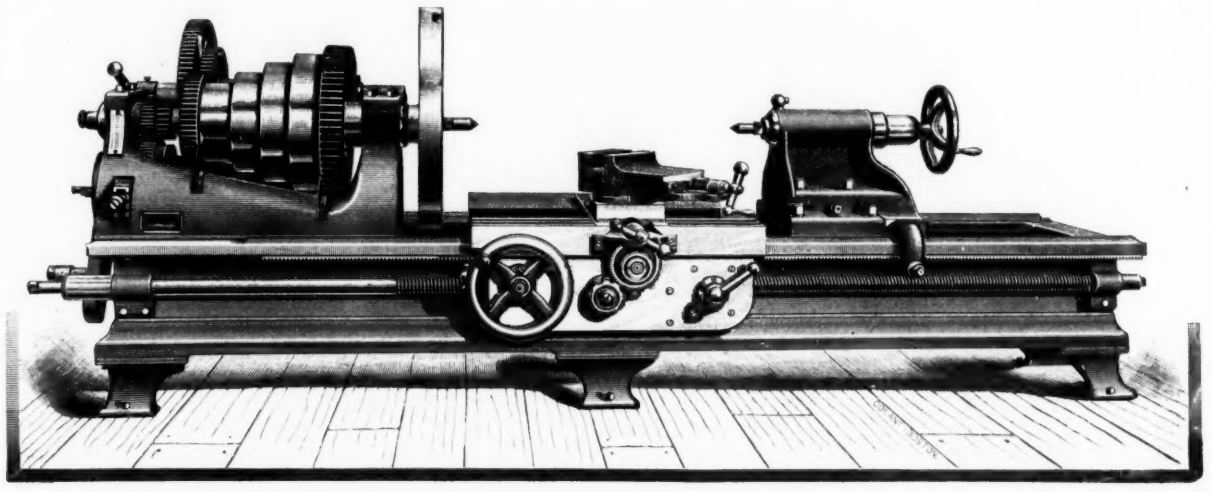
New Engine Lathe.

The lathe we illustrate herewith is built by William Gleason, Rochester, N. Y. It swings 38 inches, and is built from heavy patterns.

A double set of gears on the cone and back shaft gives 12 speeds to the spindle. This arrangement gives great power, for the cone makes 15 revolutions to one revolution of the spindle, when in the strongest gears. It also gives a very uniform drop from belt to gear speeds; therefore work of all diameters is done at good advantage.

The lathe has an independent friction and a power cross-feed, by means of a slot cut in the lead screw, and it is so arranged that the threads of the screw are in no way injured for screw cutting.



NEW ENGINE LATHE.

The feed is secured by a train of gears, no worm screw being used.

The lead screw is made of steel, is cut two threads to the inch, and has an open and shut nut. When even threads are being cut, the nut can be opened, and the carriage run back on the rack, without the use of the slow back motion on the screw, and have the tool commence accurately in the thread again.

The rack and all the small feed gears are steel, and cut from solid stock. The largest section of cone is 22 inches in diameter, and each section is 4¼ inches wide. The front bearing in the head stock is 8 inches long, and 4¾ inches in diameter.

The live spindle is made from dense high-grade steel, and runs in composition boxes of six to one, copper and tin.

Swing over carriage, 24 inches. The ways are large, and the carriage bearings deep and long, giving a broad wearing surface. The carriage is fitted so as to square and bore accurately.

The lathe is furnished with small and large face plates, center rest, follower rest, side turning rest, and change gears, to cut from 1 thread in 2 inches to 12 threads in 1 inch.

12-foot bed, 38-inch swing, turns 5 feet 10 inches. Weight, 10,000 pounds. The general selling agents are Hill, Clarke & Co., 36 Oliver street, Boston, Mass.

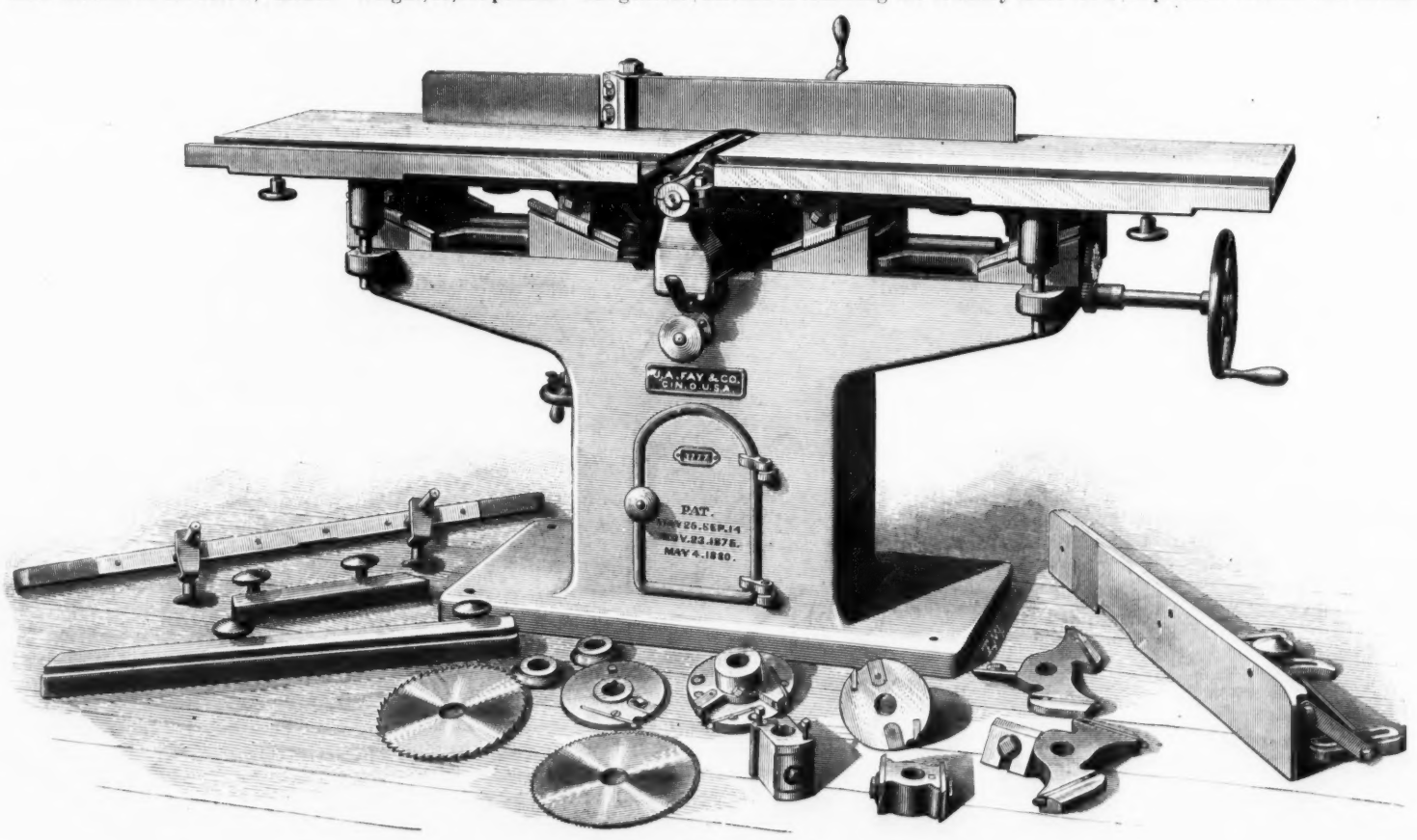
It has been our pleasure to chronicle many advances in the wages paid workmen during the past six months, these advances being frequently voluntary on the part of employers, and at other times amicably arranged by conferences. In view of this fact it is somewhat surprising to find that the price of a vote in the Legislature at Albany has fallen to so low a figure. It is said that a vote which a few years ago was considered cheap at one thousand dollars, now goes begging at one hundred. It is the most remarkable cut-down in wages we ever remember to have heard of.

The town of Marshall, Mich., has discovered a new way of raising money with which to pay bonuses to manufacturers. Instead of remitting the ordinary taxes for a term of years from the plant of new manufacturers, Marshall proposes to turn in the proceeds of the tax on its saloons to a fund for the establishment of new manufactories. A coffin factory is what they want just now, which may mean that the saloonkeepers are to be taxed to death and may not.

No. 3 Solid Frame Variety Wood-Worker.

The machine herewith illustrated is from the well-known builders of labor saving wood working machinery, J. A. Fay & Co., of Cincinnati, O. It is an illustration of a new form of wood working machines, which is worthy of study, as it combines the functions of the horizontal surface dresser ordinarily used in hand planing and variety wood working machines, and a vertical surface dressing attachment, by which two surfaces can be operated upon at the same time in squaring up. It will plane out of wind, surface straight or tapering, rabbet door frames, etc., rabbet and face inside blinds, joint, bevel, gain, chamfer, plow, make glue joints, square up bedposts, table legs, newels, etc., raise panels, either square, bevel, or ogee, stick beads, work circular moulding, rip, cross cut, tenon, bore, rout, rabbet and edge door frames, rabbet joint and bead window blinds, work edge moulding, etc.

The tables are made of iron, planed perfectly true, and have simultaneous and independent vertical and lateral adjustments,



VARIETY WOOD WORKER.

by means of the hand wheel at the working end of the machine for always retaining the proper distance between the periphery of cut and edge of table.

All the different functions of the machine are secured by the use of two tables, thereby effecting a saving of time in making the adjustments. The tables are made with

grooves to receive the gaining frame, and are made continuous by filling pieces connected with them when so used. For sawing, a short supplemental table is inserted between the other two, making a continuous saw table.

The horizontal arbor is of steel, of large diameter, and revolves in bearings supported on the column. The bearing on the front side of the machine is planed in a seat, the height of which to the center of the arbor is equal to one-half the diameter of the largest head to be used. It is readily detachable for the purpose of substituting different heads. This is important, as it gives greater stability to the arbor and obviates its liability to spring. The bearing on the back of the machine is planed and gibbed in a seat, and has a lateral movement with the spindle and cutter head, for accuracy of adjustment in gaining, rabbeting, etc. This movement is accomplished by means of a small hand wheel shown on front side of the machine.

The vertical arbor is of steel and arranged to be dropped below the line of the table, by removal of the head and operating a screw which supports the vertical spindle frame. The head on this arbor is of steel, slotted on all four faces, and it with the arbor is so arranged that its cutting surface is in line with the end of the horizontal planing head, so the full limit of the knife on both surfaces can be used.

Fences are sent with the machine for different classes of work. The regular fence for use when not operating the vertical surfacing attachment, is attached to and forms a part of the forward table, always maintaining its proper position in relation to the knives. It is adjustable across the table, is fitted to receive pressure springs for holding down stuff, and it swings to different angles for beveling work. The other fences are used in connection with the vertical cutting head. One of them is arranged to guide the work to the head, and can be graduated to differences of cut. By an arrangement of special fences, the material after being faced upon two sides can be run through and the other two sides gauged to correct thicknesses.

This vertical surfacing attachment is used in rabbeting and edging door frames, rabbeting, jointing and beading, and squaring up two sides at once. Planing to a width, etc., can be readily done with both horizontal and vertical heads in operation. The horizontal head planes 9″ in width. The vertical head may also be used for edge moulding or friezing.

Extra heads for grooving, paneling, moulding, etc., of various kinds are furnished when desired. It can be equipped with a boring and routing table, having vertical and lateral adjustments to suit the sizes of stuff to be worked.

The *Northwestern Republican* says the gauge of the Toledo division—207 miles—of the Toledo & St. L. R. R. will be changed in one day. The change will be made next month.

The Acme Center Square.

This little tool is a center square, try square and bevel in one. The squaring points are two steel pins, the graduated blade being stationary and at right angles to these pins. It will be seen that the pins will square from the inside of the hole as well as from the outside of the surrounding metal, which adds largely to the utility of the tool.

For laying off bevels the loose blade is swung to the required angle, and held by the thumb screw. The upper blade can be removed if desired, and quickly replaced when wanted for bevel work.

The manufacturer of this tool is Hugh E. Ashcraft, Arlington, N. J.

The Diamond Grate Bar.

In this grate bar the effort has been to get a large amount of air space with such a distribution of metal as will give strength and lasting quality; also to subdivide the air space in such a way as to bring about that complete distribution of oxygen essential to complete combustion.

The air space with this bar is said to be 75 per cent. of the total grate area, while the construction is such that a thick body of metal is nowhere required. This makes the bar comparatively light, and not liable to warp, because air coming in contact with the thin sections of metal rapidly abstracts the heat.

The manufacturers are James Mahony & Son, 245 Broadway, New York.

The Diamond Grate Bar.

Fault Finding in the Machine Shop.

By Frank H. Richards.

No man has made a bigger mark upon the century than the machinist. I am disposed to set up fault finding as his supreme function. We are accustomed to admire and magnify the locomotive and the steamship as among the crowning achievements of mechanical skill. If I should say that they are more than anything else the noble and enduring monuments of the fault finding habit of the craft, I would be not far from the truth.

It was not a mechanic who originated the saying that "necessity is the mother of invention;" for, in fact, it is fault finding that is the prolific parent of improvement. The way we have of being dissatisfied with things as they are, and of looking unceasingly for a better way of doing a thing, and immediately for another way better than that, makes things to grow constantly, and the growth is mostly by the steady accumulation of very slight additions to our knowledge of mechanical ways and means. Step by step is man's natural mode of progression, and his up hill steps are the shortest. So the history of any invention of value must be a voluminous one. The fullest detailed description of the locomotive of today would not cover one hundredth of the bulk of a description which should embrace all the changes of every part through the successive stages of its growth. Such a description would include, besides the changes that have been successively adopted and superseded, those that have been tried and proved failures from the first, and those also that have merely been proposed and rejected without even a trial. For this is the way of invention. The inventive mind is fault finding all the way through, with itself more unsparingly than with all outsiders. Any inventor who has successfully pounded his brains over some new and complicated machine will tell you that his task has been not so much the discovery of a single way of doing any detail of it, as in selecting by the fault finding process the best of many ways thought of. The host of worthless patents flowing from the Patent Office are from the one-sided, short-sighted and self-satisfied little inventors who, when they strike a way of doing a thing, hastily conclude that they have struck *the* way, and hurry to secure it, while there are probably a hundred other ways, and fifty better than theirs. An inventor who would accomplish anything of value must be an inveterate fault finder, and should invite instead of repelling the fault finding of his friends. One of the best mechanics and inventors in the United States once had a compliment addressed to him—not in a complimentary tone, however—after this fashion: "Why, George, I believe if you'd been around when God A'mighty was making the world, you would have had your improvements to offer." I certainly believe George would, but if after all he had found that the way of the Supreme Inventor was best, none would have appreciated and acknowledged it quicker than he. A much littler mechanic and inventor that I once knew established a life-long quarrel with the Master Mechanic when he found that the universe was not run entirely according to his little ideas. No doubt he had a right to assume that position, but he would have no right to carry such an opinionated attitude into a modern machine shop.

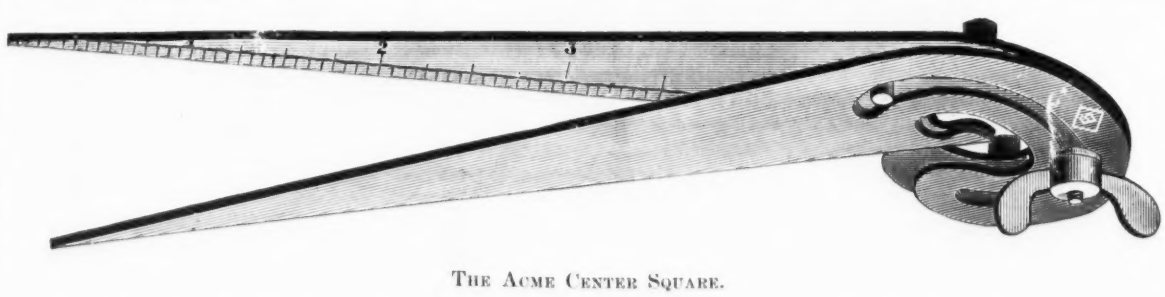
Many, both in the trade and outside of it, have remarked the good fellowship and helpfulness among machinists. I believe it is exceptional, and can be found to the same degree in no other trade. I personally acknowledge, with the liveliest gratitude, the constant kindness, the innumerable helpful acts and suggestions I have received from associates in the shop, and the almost entire absence of manifestations of an opposite spirit. Nearly every machinist of long experience would have to testify the same. Now, please don't smile when I assure you that it is the fault finding habit which begets this friendly disposition. Just look at it with me. Fault finding is the most commendable and necessary of all habits in a machinist, because every machinist is, by the nature of his calling, an inventor. He is out of place in the shop if he is not able, to some extent, to devise new ways of doing the old things and ways of doing things that were never done before. Every day with me some machine is broken down, that must be immediately repaired—say, some casting on a printing press to be patched. There are many ways of doing it, and the fault seeking habit, which is, of course, behind the fault finding, sifts all the ways, and makes its wisest selection. It welcomes and invites suggestion, and reciprocally is ready to offer its suggestions to others. Fault seeking and fault finding is helpful in motive, and cannot be born of enmity, but is the ripest fruit of friendship. If you have a new job on hand, and any genuine old machinist comes along while you are at it, he will find it almost impossible to get away without having some fault to find with your way of doing it, and some argument to offer in favor of some other way; and you will be a fool if you do not appreciate at least the motive that prompts it.

Fault finding is a foreman's business. His ability in that direction should be the test of his fitness. The first question for a proprietor to ask concerning him should be: "Is he a good fault finder?" If he is not, by all means let him take charge of somebody else's shop. As fault finding is the price of existence to the modern machine shop; as, in the strife and competitions of business, methods must be criticised and improved constantly, so that others shall not secure the advantage of us, there is not necessarily the least savor of malice or unpleasantness about it. A workman who resents honest criticism is always in the wrong. This is one curious experience any foreman is likely to have. His best workmen always welcome honest and intelligent criticism. There is no surer mark of mediocrity, and the grades below it, than restiveness. It is only the man of the narrowest knowledge who knows it all.

Against honest and valid fault finding no excuse should stand. Of all wasted ingenuity, that employed in the devising of excuses is probably the least satisfactory. I know fellows who are seldom right, and yet who are never caught without an excuse. A fellow can't be expert at everything, and the most expert at excusing himself is so much less expert at improving himself. If any one can't stand fault finding, find more fault until he gets quiet and comfortable. If any workman is disposed to feel aggrieved, it will be well to remember that after the foreman has done his utmost he probably has to stand a hundred-fold more fault finding than the most aggrieved individual workman has to.

Excellence of product can only be maintained by persistent and systematic fault finding. It is often enough remarked that when a new article of value has made its market, and is meeting a large demand, it is too apt to deteriorate in quality or to become in some way defective, and the purchaser feels aggrieved, and we hear many reflections upon the honesty of the producer. The slur is not always just. The producer probably has no intention of slighting the article he is manufacturing. He probably simply lets up a little with his fault finding at a time when it is more necessary than ever. As the number of articles produced is increased, as the number of men employed in the production is increased, the difficulty of keeping them up to the standard is increased. A hundred men will be more careless, will make more mistakes, will even be more dishonest than ten men. But judicious fault finding comes in and transforms the fact and finds its advantage in it. For it is, no doubt, true that by a wise selection, which is fault finding, there is more and higher skill to be found, more ways of doing things suggested, and some of them better, more faithfulness and diligence, more honesty, among a hundred men than among ten. So there are, and always must be, large establishments whose product is superior to, and more reliable than, that of any small establishment in existence. It is legitimate advertising for a concern to boast of its magnitude. Nothing but fault finding can keep it up, however. We often have fellows come along looking for a job who tell us that they are from Brown & Sharpe's or Pratt & Whitney's, or some other well-known firm. They could not offer a worse recommendation for themselves, for common sense tells us that they are the refuse of the fault finding sieve.

Fault finding is a necessity, because it is not sufficient merely to maintain the present standard in anything. The standard must be advanced because everything else advances. Great victories belong not to defensive warfare; everything must be aggressive. The best thing in the market to-day will not be a salable article ten years hence. The best is only relatively good, and can only hold its own by constant fault seeking, fault finding, and improvement. Many



The Acme Center Square.

articles that were highly valued at the time of their first appearance, have been driven out of sight because their proprietors have been satisfied to sit down and rest from their fault finding for a while. Nothing simply holds its own; the rising tide will drag the anchored vessel under.

The suggestions of workmen regarding improvements to their work are, as a rule, always well meant, are often of great value, and should be respected and encouraged. Never slight the remark of a man who has the least suggestion to offer of possible improvement regarding the work he has in hand. If there is too much stock upon a casting, or too little stock, or if it does not correspond with some other part of the machine, or if it is too hard, or not as sound as it should be, these are legitimate fields of fault finding in the workman, and there is no surer way of making money than in giving attention to a statement of such items and immediately correcting them. If an improved method of doing a piece of work is suggested, or a special tool or jig for it, it should be immediately attended to. I have known a different policy pursued, where all the interest of the workman was systematically (if there could be said to be a system anywhere) frozen out, and with most disastrous and fatal results to the firm.

As the fault finding habit is only the fault seeking habit in successful action, and as nothing is a fault except when it stands in the way of something better, so true fault finding is always suggestive. No man living can in fact find fault with anything until he can either actually show something better, or at least the possibility and hope of it. Profitless or aimless fault finding is a misnomer; it finds nothing, it is simply grumbling, which is as vicious and detestable as genuine fault finding is virtuous and profitable.

Finally, brethren, let us not slacken or weary in fault seeking, let us glory in fault finding, and let us steadfastly believe that so we are helping the world along.

Practical Drawing.

By J. G. A. MEYER.

TWENTY-FIFTH PAPER.

245. From the principles heretofore given, we conclude, that when the projections of any two points of a straight line are given or known, the projection of the line is also known; because a straight line drawn through these points will be the projection of the line.

All the principles previously given are applicable to the projections of planes, which we shall now explain.

PROJECTIONS OF PLANES.

246. Let *A B C D* (Fig. 179) be the vertical, and *A B E F* the horizontal plane of projection, and *s t u v* a given plane in space, this given plane is parallel to the horizontal plane of projection; it is required to show the manner of finding its projections.

The given plane is bounded by the straight lines *s t*, *s u*, *v u* and *v t*. We now find the horizontal projection of each one of these lines according to the method given in Art. 233; the horizontal projections $s_3\ t_3$, $s_3\ u_3$, $v_3\ u_3$ and $v_3\ t_3$ thus found will be the boundaries of, and complete the horizontal projection of the given plane.

In finding the horizontal projection of this given plane we may also apply the principle given in Art. 245. In this case we simply find the horizontal projections s_3, t_3, u_3, v_3, of the points *s*, *t*, *u* and *v*; and then join these points by straight lines, these will complete the horizontal projection of the given plane. Now, in order to find the vertical projection of the same plane it should be remembered that, since the given plane is parallel to the horizontal plane of projection, it follows that the given plane must be perpendicular to the vertical plane of projection, and therefore when the projecting plane is passed through the line *s t* it will also pass through the given line *u v*, and therefore the trace $s_2\ t_2$ of the projecting plane will be the vertical projection of both the lines *s t* and *u v*.

By revolving the vertical plane of projection around the ground line *A B*, till the vertical plane coincides with the horizontal plane of projection, it will then appear as shown in Fig. 180. The vertical projection of the given plane will be simply a straight line $s_2\ t_2$ parallel to the ground line *A B*, and the horizontal projection a rectangle $s_3\ t_3\ u_3\ v_3$. It should also be noticed that since the given plane is parallel to the horizontal plane *A B E F*, the projection $s_3\ t_3\ u_3\ v_3$ will show the correct length and breadth of the given plane. Now take another case:

247. Let *A B C D* (Fig. 181) be the vertical, and *A B E F* the horizontal plane of projection; *s t u v* a given plane in space, the given plane is perpendicular to the vertical plane *A B C D*, but not parallel to the horizontal plane of projection. The projections of this given plane are found in the same manner as that employed in finding the projections shown in Fig. 179. After the vertical plane has been turned around the ground line *A B*, to coincide with the horizontal plane of projection, these planes and projections upon them will appear as shown in Fig. 182. In this figure we see that the vertical projection of the given plane is a straight line $s_2\ t_2$, which is not parallel to the ground line and therefore indicates, as it should do, that the given plane is not parallel to the horizontal plane of projection. The horizontal projection of the given plane is in this figure also represented by a rectangle $s_3\ t_3\ u_3\ v_3$, but since the given plane is not parallel to horizontal plane *A B E F*, the projection $s_3\ t_3\ u_3\ v_3$ will show the correct breadth but not the correct length of the given plane. The correct length is obtained by measuring the vertical projection of the given plane, that is, the line $s_2\ t_2$.

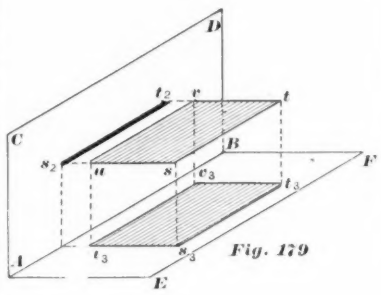


Fig. 179

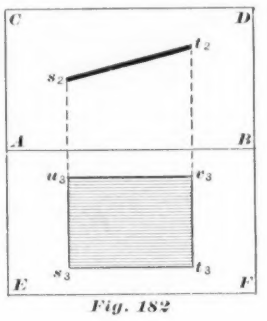


Fig. 182

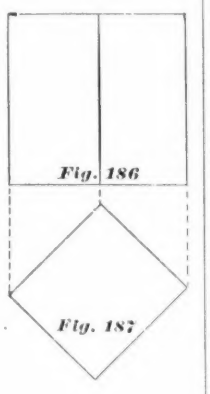


Fig. 186

Fig. 187

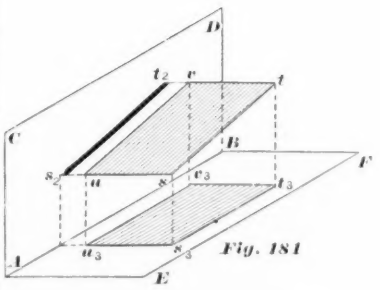


Fig. 181

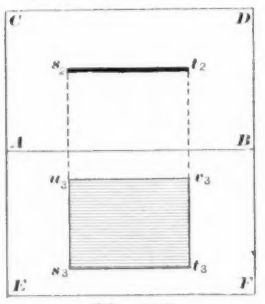


Fig. 180

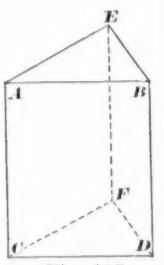


Fig. 183

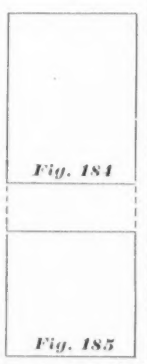


Fig. 184

Fig. 185

APPLICATIONS OF THE FIRST PRINCIPLES OF DESCRIPTIVE GEOMETRY TO PRACTICAL DRAWING.

248. In explaining the first principles of descriptive geometry it was deemed necessary to show the outline of the planes of projections, and also the ground line which separates the planes of projections after one of these has been turned around the ground line to coincide with the other. In practical drawing it is not necessary to show the outline of the planes of projections or the ground line which separates them, and, therefore, in working drawings these are never shown. But it should be always understood that the surface of the paper represents the planes of projections all lying in one plane; and that since the principles by which the projections of any solid are found, are precisely the same as the principles upon which practical drawing is based, it follows that the different views, such as elevations, plans and sections of machinery or other objects, given in a regular working drawing, are nothing more or less than what we here call projections of the object.

Omitting in working drawings the outline of the planes of projections, also the ground line which separates these planes, will in nowise interfere with the strict applications of the foregoing principles; indeed, the principles of descriptive geometry must be correctly applied and followed in all practical drawing, otherwise failure in the correct representation of mechanical or other objects will be the result. Hence the necessity of first explaining these principles as we have endeavored to do, and also the necessity of the student studying and understanding the same before an attempt is made to apply these principles; and if these are thoroughly understood progress will be comparatively easy and pleasant to pursue; otherwise, the study of practical drawing will become irksome and discouraging, often causing the student to throw the whole subject aside as something mysterious and too difficult to master.

PROJECTIONS OF RIGHT PRISMS.

249. Before we attempt to make a drawing of, or project a prism, let us become familiar with the definition of a prism.

Definitions.—A prism belongs to a class of solids called polyhedrons. A polyhedron is a solid bounded by polygons (Art. 129).

250. A prism is a polyhedronin which two of the bounding polygons are equal in all their parts, and also parallel to each other. The other bounding polygons are parallelograms. Thus, in Fig. 183, which represents a prism, the polygons *A B E* and *C D F* are equal, and parallel to each other, the other polygons *A B C D*, *B D F E* and *A C F E* are parallelograms and may be or may not be parallel to each other; in this particular case they are not parallel.

251. The bounding polygons are called the faces of the prism (the mechanic will here recognize that the "faces" are what he would call the sides), and the lines in which these faces meet are called the edges of the prism.

252. The two equal and parallel faces, as *A B E* and *C D F*, are called the bases of the prism: one the upper, and the other the lower base; the lines *A C*, *B D*, *E F*, in which the lateral faces *A B C D*, *B D E F*, and *A C E F* meet, are called the lateral edges of the prism.

253. The altitude of the prism is the perpendicular distance between its bases or the planes of its bases.

254. A right prism is one whose lateral faces, as *A B C D*, etc., are perpendicular to the bases. In this case the lateral edges will also be perpendicular to the bases.

255. A prism is named from the number of sides of its bases; thus a triangular prism is one whose bases are triangles; a hexagonal prism is one whose bases are hexagons, etc.

256. The manner of projecting a prism is clearly shown in Fig. 164; and the appearance of these same projections when the vertical plane of projection coincides with the horizontal plane is shown in Fig. 165. In connection with these illustrations it may be remarked, and these remarks also apply to machine drawing, that the prism shown in Fig. 164 may be placed as close to the planes of projections as we choose to do. If we place the prism closer to the planes of projections than shown in Fig. 164, the projections in Fig. 165 will also be closer to each other, or, in other words, the plan will be closer to the elevation of the prism.

257. From these considerations we conclude, and rightly too, that the distance between a plan and elevation of a machine or other object is arbitrary; generally it is a matter of choice; if too far apart it will be inconvenient to compare one view with another; if too close clearness will be sacrificed.

258. Again, we may place the prism in a number of different relative positions to the planes of projections. For instance, we may place the prism in such a position from which we will obtain projections as shown in Figs. 184 and 185; we may also place it in a position from which we will obtain projections of the prism as shown in Figs. 186 and 187. In both cases we give the correct dimensions and form of the prism; the workman can shape his material from the two views of the prism as given in Figs. 184 and 185; he can also shape the material just as correctly and easily if the prism is represented as shown in Figs. 186 and 187. Here then the question may arise, In what relative position to that of the planes of projections should we assume a prism, or any other object, or any kind of a machine, to be placed to produce a good working drawing? To this we answer: Always assume the prism to be placed in such a position which will give the least labor in making the projections. Now, since Figs. 184 and 185 can be drawn with less labor than Figs. 186 and 187, we conclude that prisms should be assumed to stand with some of their faces parallel to the planes of projections, whenever that is possible. The same remarks apply to ordinary working drawings; and, since the surface of the paper represents the planes of projections, we should always assume that the principal surfaces or center lines of a machine, or, in short, we should assume that the machine, or other object to be drawn, stand parallel to the surface of the paper.

259. Now fasten a fresh sheet of drawing paper to the drawing board, draw the border lines, and divide the sheet into the same number of spaces as the last sheet, as directed in article 124 and illustrated in Fig. 96.

Messrs. Thornycroft & Co., of Chiswick, in making preliminary trials of a torpedo boat built by them for the Spanish Navy, have obtained a speed which is worthy of special record. The boat is twin-screw, and the principal dimensions are: Length 147 feet 6 inches, beam 14 feet 6 inches, by 4 feet 9 inch draught. On a trial at Lower Hope on Wednesday last the remarkable mean speed of 26.11 knots was attained, being equal to a speed of 30.06 miles an hour, which is the highest speed yet attained by any vessel afloat.—*Engineering.*

Hammers operated by gas instead of steam are now made in England, and the claim is put forth that they are very economical in operation.

J. F Holloway, for many years president and general manager of the Cuyahoga Steam Furnace Company, of Cleveland, Ohio, has accepted a position with the firm of Henry R. Worthington, and will hereafter reside in New York city.

Coryell's Steam Actuated Valve Movement.

This valve movement is for direct-acting steam pumps, the claim for it being that it is absolutely positive, that its action is such as to permit quicker running, and that the parts are very few and simple, with the least possible liability to get out of order. The operation will be understood by referring to the engravings and following the description through a stroke of the pump:

In the middle of the steam chest *E* is a plunger *D* carrying the main valve *C*. At each end of the chest are auxiliary cylinders *F F* with their pistons *G G* having rods or stems *H H*. Ports *I J* lead from the main steam cylinder to the outer ends of the auxiliary cylinder *F F*. Ports *K K* lead from the cylinder or main ports to the inner ends of the auxiliary cylinders *F F*. Commencing with the piston in the center of the cylinder, and supposing it to move to the position shown in cut (having passed port *I*) both ends of plunger *D* being open to the steam on the same side of the piston it is balanced, but auxiliary piston *G* being exposed to the pressure of live steam at one end through ports *I J*, and to the exhaust at the other end through port *K*, is forced forward and its stem *H* being in contact with plunger, the latter is caused to move through a portion of its stroke, and until the main valve has partially opened and occupies the position shown in the engraving. Then live steam will enter the auxiliary cylinder through port *K*, while *I J* is open to the exhaust. Auxiliary piston *G* will then return to its former position at the outer end of its cylinder.

The main piston in the meantime has started on its return stroke at a moderate speed until it has repassed port *I*, when plunger *D* being subjected to the pressure of live steam through port *I*, and open to the exhaust at the other end will complete its stroke, and the main valve being then wide open, the speed of the piston will be accelerated. This increased speed will be maintained until towards the end of the stroke, when it is retarded by the compression of the exhaust and the reversal of the main valve before the completion of the stroke.

It will be readily seen from the above that the action of this pump will closely approximate that of a crank and fly-wheel pump with the advantage that it can be run as slowly as may be desired, and will stop and start at any point in the stroke.

This valve motion may be readily adapted for the duplex system by having the auxiliary ports leading to the auxiliary cylinder of one engine connect with the main steam cylinder of the other, so that each will give the initiatory movement to the plunger of the other. The ports leading from the ends of the plunger will, however, connect with the steam cylinder of each as in the single pump.

Used in the duplex system it is claimed that, no matter how unequally the pistons or rods may be packed, each pump will make its complete stroke, and cannot fail to do so.

The inventor and patentee, Edwin M. Coryell, 167 Eckford street, Brooklyn, E. D., N. Y., has brought out this movement as a result of a good deal of experience in designing and manufacturing steam pumps for a variety of purposes.

Engineering says: Herren Hurghausen and Nerust have discovered a direct mode of transforming heat into electricity. It consists in placing a thin slip of metal in a magnetic field, and maintaining its two ends at different temperatures, when a difference of potential is found between the two opposite sides of the slip. The direction of the current is reversed by reversing the direction of the magnetic field. The effect is, however, very slight. With a square plate of bismuth, measuring 5 centimeters on each side, and 2 millimeters thick, a field of force represented by 5,000 C.G.S. units, and a difference of temperature caused by placing a mica plate against two sides of the bismuth, one dipping in cold water, and the other heated by a gas flame, the resulting difference of potential was only 0.00125 volts. With iron instead of bismuth, the current is in the reverse direction.

The Transmission of Power by Belting and Gearing—Jack Shafts.

By W. H. Hoffman.

The modern steam engine has been increased in power to such an extent, that the matter of taking power from it has assumed proportions of like magnitude. The old stationary mill engine of 30 years ago, was limited as an average to 200 horse-power, while at this writing we find many cotton, woolen, and silk mill engines, of 1,000 horse-power, and some as high in capacity as 2,000 horse-power. One large manufacturing company of New England, is now contracting for a quadruple expansion engine of 2,500 horse-power, and other similar concerns will soon follow with power equal to this. Thus it will be readily seen, that the first and second movers receiving these large powers, must be proportioned and arranged to be equal in strength to the requirements of each case under consideration.

All spinning mills have increased their speed from 40 to 70 per cent. within the past twenty-five years; not only that, but the speed and weights of parts of looms, have also been increased to an extent equal to the spinning plants. The arrangement of a jack shaft or first mover is a matter of great importance, where the power to be received and transmitted is more than 250 horse-power. In the first place, these first receiving shafts or second movers should be of a size proportioned to the power, and should be enlarged from $1\frac{1}{4}''$ to $2\frac{3}{4}''$ in diameter, where the pulleys and couplings are to be fastened on, and the pulley couplings should be held by two liberal sized keys, with heads forged on for drawing in case of accident or moving of wheels. The journals should have collars at the two extreme ends at least, projecting from the body of the shaft at least $\frac{3}{4}$ of an inch, with corners next to the shaft well rounded, while the necks of the bearings should be rounded to suit.

The bearings are of like importance, and should be furnished with all modern appliances for continuous running. The castings should be perfect in every way, sound and tough, and should have a base of a length and breadth equal to the work to be done. In all cases the bearings should be lined with either the Philadelphia, Bridgeport, St. Louis or other good babbitt metal, from specialists in journal metals. In the case of a 7″ jack shaft there should be at least a thickness of $\frac{11}{16}$ of this metal, dovetailed when cast in block at eight different points on the circle, and running the entire length of the bearing, so that the collars may run against the babbitt metal at the ends, thus avoiding any contact with cast-iron by the shaft. The oiling of these jack shaft bearings is another matter that needs close attention. Each box should, in addition to the regular oiling arrangement, be supplied with a chamber for solid lubricants, such as the Albany or the "Lawlor" grease. The oil cups should be of the sight-feed type, like Wilkinson's, or some other good one. The babbitt metal should be grooved or cross-channeled, though not to a great depth or width; but a 7″ bearing should have four at each half of the box, and at least once a week a piece of silk, attached to a wire, should be drawn through the grooves, in order to keep them clean.

In all cases where the main belts lead horizontally, or nearly so, the bearing should be in four pieces, divided in proportion, as already described by writers in the American Machinist, with wedge pieces and set nuts, to take up the wear in the direction of the pull. Each bearing of a main jack shaft should sit on a sole plate, firmly bolted to the foundation, with a space of at least $1\frac{1}{4}$ inches at the ends, to receive a cross wedge, by which the main boxes can always be kept in perfect line. The bearings for a 7-inch jack shaft should not be more than $8\frac{1}{2}$ feet from center to center, and with very heavy pulleys or gears this distance should be reduced to $7\frac{1}{2}$ feet.

In case a 7-inch shaft must be long, say, from 22 to 40 feet, it should be coupled once for the short distance, and three times for the long distance, and these couplings should be bolted by reamed bolts and cross-keyed, the bolts not less than $1\frac{1}{2}''$ in diameter, and the cross-key $1\frac{7}{8}''$ wide by $1\frac{1}{4}''$ thick. The sole plates for holding the main bearings should be deep enough to admit two elevating wedges, one at each end, to allow at all times for the settling of the foundations, as this makes an adjustment that can be applied instantly to each and all bearings.

With the present facilities for making all classes of forgings, I believe in making jack shaft couplings of wrought-iron or steel, as well as the shafts themselves and their collars.

The above describes a jack shaft placed on foundations according to my practice, and I will in another paper describe my method of hanging shafts of this kind to walls and upper floor beams without shaking the building.

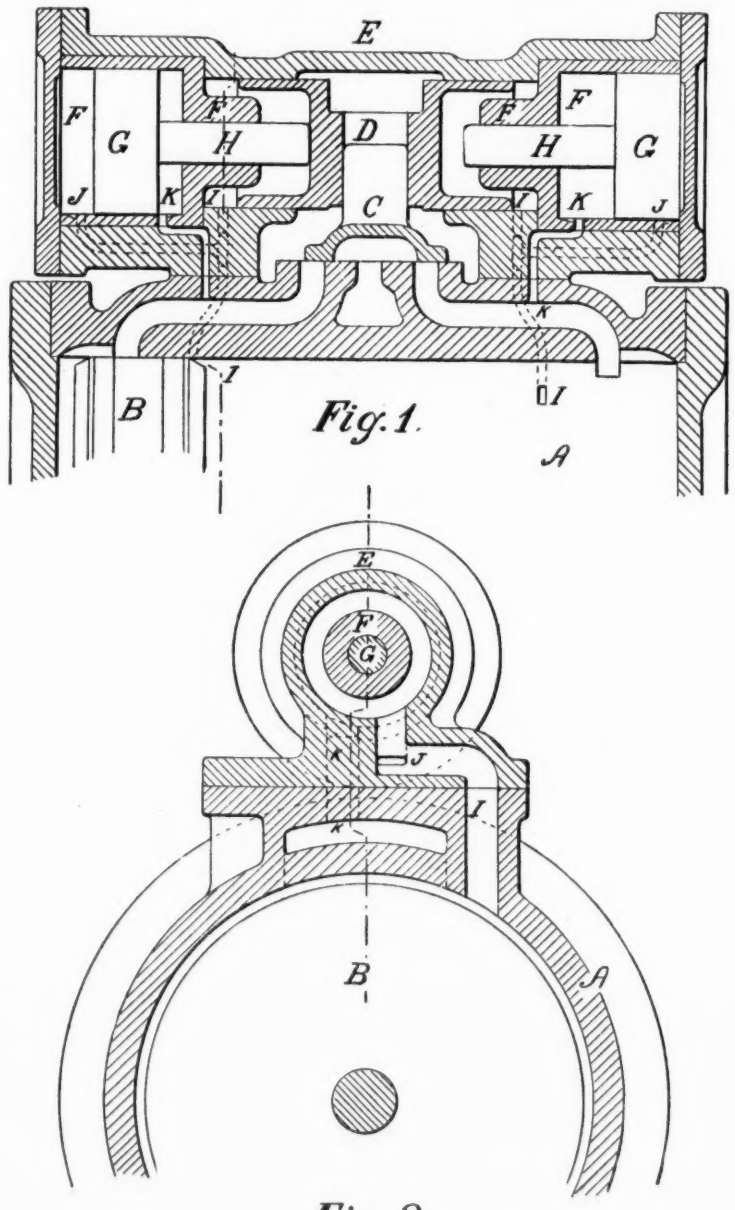


Fig. 1.

Fig. 2.

Coryell's Steam Actuated Valve Movement.

A Tilting Ladle-Car for Molten Metal or Slag.

By John Birkinbine, Philadelphia.

A paper read at the Scranton meeting of Mining Engineers.

An item of considerable importance to the producers of pig iron is the disposition of the slag or cinder from the blast furnace; and various plans have been adopted at different works to care for the rapid accumulation of this generally waste material. The charge per ton of iron made which must be allowed for the care of cinder is sufficient in times of business depression to give plants having facilities for disposing of their slags an advantage over others less favorably arranged, and to allow iron to be produced profitably in the one case and prevent a profit in the other.

The varied methods employed and the means of conveyance utilized need not be detailed. It is sufficient to say that the large outputs of American blast furnaces, and consequent rapidly augmenting dump piles, have brought into general favor the use of cars carrying the slag in a liquid condition. The advantages of this method are the prompt removal of the slag, the reduced space occupied by the dump piles, and the facility of converting the slag into such forms for use as may be desired.

The progress in iron manufacture is also marked by a more general adoption of methods by which molten metal is carried in vessels away from the point of its production; and, anticipating the prospective advance in pig iron manufacture, it does not seem unreasonable to prophesy the early abolition of casting houses at blast furnaces, particularly where several are grouped together; or the casting of steel ingots away from the converters or furnaces. In some large blast furnace plants, the iron is carried molten from the blast furnaces to the converters or other furnaces. Even where it is cast into pigs, casting sheds removed from the immediate vicinity of the furnace stack would, perhaps, be superior to casting in beds in front of the furnaces. The idea of casting sheds appears to present the following advantages:

1. The equipment of boilers, hot ovens, and blowing machinery could be closely grouped around the blast furnace stacks, permitting a reduced force of keepers and helpers to operate them, and all the molten

iron and cinder could be removed with a minimum of labor in suitable vessels, the former to the dump pile, the latter to the casting sheds.

2. The casting sheds could be made of short spans, so that their width would make a convenient length of runner, thus securing an equal amount of casting room at less cost than that of the usual casting houses of similar capacity. These sheds could be well ventilated and provided with special appliances for handling the pig iron from the beds to the cars, etc.

3. A special force of men could be constantly employed in moulding pig beds or removing iron; and it is possible that economy would indicate the use of a pig bed moulding machine.

4. The cast would be more uniform in grade, owing to the mixing of the metal in the conveying vessel. By having the discharge under absolute control, the losses from boils, over or underrun pigs, and pig bed scrap would be materially reduced, and a smaller force of employes would be able, by judicious arrangement of the plant, to cast and handle more iron, with less discomfort and risk, than by the system ordinarily pursued.

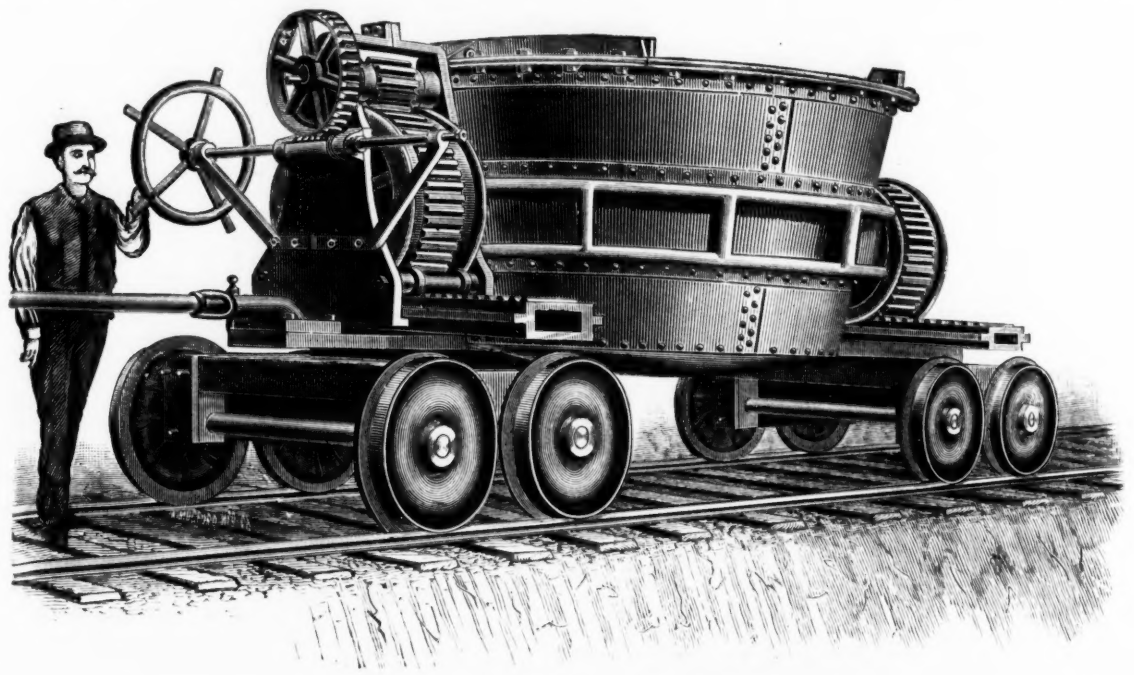
Such casting sheds would materially alter the arrangements of blast furnace plants with which we have become familiar, and permit, in many cases, savings in the arrangements of tracks for receiving raw material or shipping the product, as well as possible economies in construction, or the location of furnace plants at sites, now considered disadvantageous.

The car illustrated consists of two four-wheeled standard gauge trucks, provided with locomotive equalizing bars, so as to maintain contact between the wheels and rails while passing the uneven tracks common to cinder dumps. A heavy cast-iron bolster is pivoted over each truck, the upper faces consisting of a toothed rack, which engages the teeth of shrouded master wheels secured to a cast-iron bail encircling the ladle or kettle. This bail is not attached to the kettle, but sustains it by an angle iron ring; and ears placed below the bail prevent the kettle from dropping out when reversed, thus allowing for freedom of motion of the ladle during the expansion and contraction consequent upon sudden and severe changes of temperature. A hand wheel and worm gear give motion to a shrouded pinion which engages one of the master wheels, causing it to revolve, the cast-iron ball carrying the motion to the other master wheel. The kettle is lined in the ordinary manner, with fire-brick or refractory material.

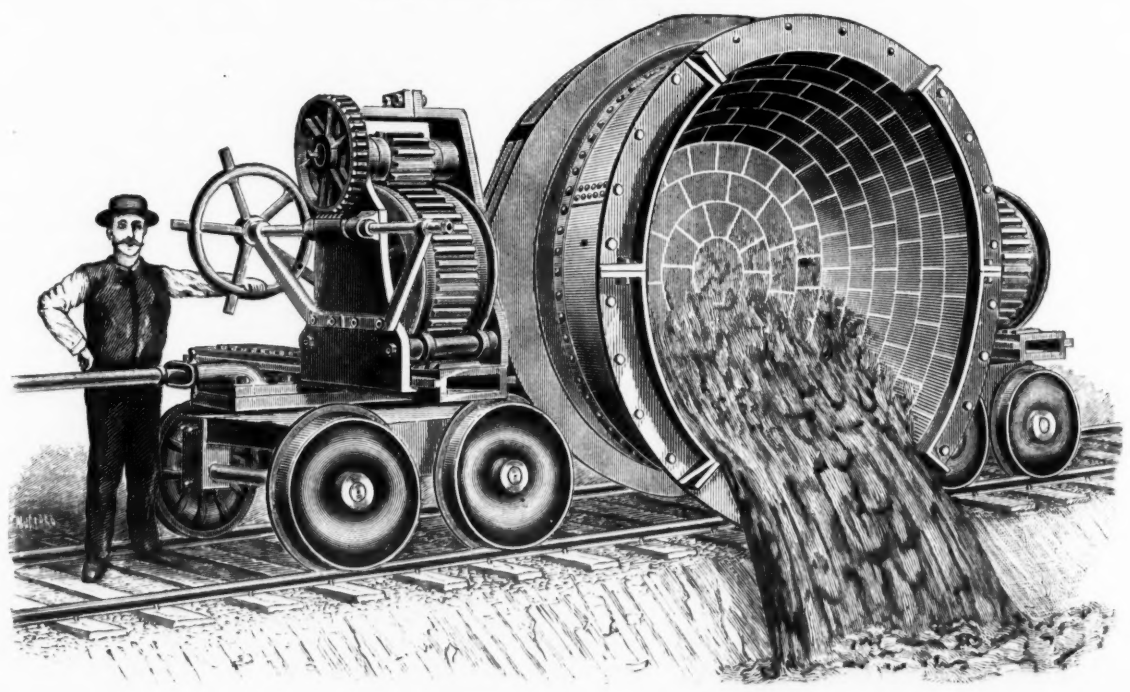
When ready to receive a charge of molten metal or cinder, the vessel is in a vertical position, the master wheels in the middle of the horizontal racks, and the cast-iron bail carrying the weight by the angle iron ring secured to the kettle. When the charge of cinder or metal has been run, the car is taken to where the cinder is to be dropped or the metal cast, and, by means of the hand wheel, the worm gear, and the shrouded pinions, the master wheels are revolved on the horizontal racks, thus tipping the ladle to any desired angle on either side, and at the same time carrying the spill beyond the tracks on which the car runs, the rate of discharge being under the absolute control of the operator at the hand wheel. One ladle of 110 cubic feet capacity has been emptied of liquid cinder and returned to a vertical position in fifteen seconds. It could be emptied as much slower as might be desired.

When the contents of the ladle have been discharged, the vessel is raised to a vertical position, by the worm gear, either while the car is at rest or while it is in motion.

Where it is desired, a cover can be placed over the ladle to protect molten metal, and, by inserting a tap-hole in the bottom, metal taken from a furnace can be cast through it, and the vessel then reversed to remove all "skulls" or *scoria* before they harden in it. Whether the idea could not be carried further, and the system extended to making small converters on trucks, is left for future investigation.



TILTING LADLE-CAR WITH LADLE UPRIGHT.



TILTING LADLE-CAR WITH LADLE TILTED.

The car here illustrated is constructed under patents by the Weimer Machine Works Company, Lebanon, Pa. It weighs about 10 gross tons, and the ladle has a capacity of 110 cubic feet. It is made to run on standard gauge (4′-9″) railway tracks, and proportioned for molten slag. When metal is carried, the strength would be correspondingly augmented.

As now in use, this car is employed for filling cinder banks, and for the production of metaling for railroads by running the slag in thin sheets, which are broken by contraction into approximate cubes. It can be utilized in connection also with water-granulation of cinder, or the casting of cinder paving blocks. As a conveyor of metal it appears to be adapted for heavy castings in foundries, and for carrying molten iron from blast furnaces to foundries, convertors or furnaces. As a cinder car it can be used for dry as well as liquid cinder. When employed to discharge liquid slag over the rim, it is free from the objections to the form of cars with gates, where "skulls" form, which must be broken out with considerable cost for labor, loss of time and damage to lining. In six months' use with liquid cinder, no lining has had to be renewed or patched in the tilting ladle described, while in the ordinary form with tap-hole such repairs are frequent, and linings last but from one to two months only. The illustrations exhibit the car in a vertical position, with the shrouded gear wheel in the center of the horizontal rack, and also with the ladle tipped to spill the cinder, the gear wheel being run out towards the end of the rack.

"I don't want any steam power in mine," said a Missouri miller. "I have a nice little water power and my mill runs steadily and smoothly the year round, with no expensive engineer, no coal bills and no trouble of any kind."

"I thought I heard that your dam was washed out last spring," said a brother miller.

"That is true," was the reply, "and it cost me about a thousand dollars to put in a new one, but it didn't stop the mill long."

"And you had to put in a new wheel and a new step, later, didn't you?"

"Yes, and that was when I was crowded with orders, too. That cost me half a thousand, but I am thoroughly satisfied with water power, and wouldn't have steam."

"Well, I've got a fine little engine, with a good man to run it. His wages are $50 per month, and my fuel costs about the same. I haven't spent over ten dollars in repairs for two years, and I can rely on my steam power every day in the year. I wouldn't take a water power and its outfit as a gift if I had to run my mill with it."

All of which shows that it is hard to get two men to agree on some questions.—*The Weekly Northwestern Miller.*

Boiler-Making Method.

Hilles & Jones, Wilmington, Del., write us regarding the boiler-making method employed in their boiler shop, as follows:

Our method is to do all we can in standard sizes, and have machinery to make those sizes a speciality. We use a spacing table for punching the rivet holes to make them perfect. We then plane the edges of all plates for calking, then bend the plates with our patent rolls, drive the rivets by steam, and calk the seams with Connery's patent calking tool. The reinforcing of manholes, handholes or other openings made in the boiler is done in the best manner with heavy wrought-iron rings or strengthening plates.

Ex-Gov. Chas. Foster, of Fostoria, Ohio, in a recent interview with a reporter of the *New York Times* about the natural gas "boom" now going on in that part of the State, said, disclaiming the boom:

"No, not a boom; booms are usually short-lived, and spasmodic jumps in real estate or other property are not always the best fortune for growing towns. We have natural advantages here, which have been greatly enhanced by the discovery of natural gas, of which we have an abundance. With five great railroads—the Baltimore and Ohio, the New York, Chicago and St. Louis, Columbus, Hocking Valley and Toledo, Lake Erie and Western, and the Ohio Central—our means of communication are unusually good. We are now building a pipe line to Toledo, and will carry natural gas into that city in about sixty days. This line of pipe will cost a large sum, fully as much as a double-track railroad. Wrought-iron pipe of the best quality is required, and is hard to get, because of the discovery of gas in so many sections of the West, and the line complete will cost not less than $3,000,000. Here in Fostoria we will lay a line of pipe around the city, for the purpose of supplying fuel to such manufacturing establishments as find it to their interest to locate here. The cost of gas will be merely nominal, just enough to maintain the line. A number of large establishments are coming here to locate, and a number of iron and machine works, which require a uniform heat to successfully turn out good work, glass works and the like. One of the best equipped flouring mills in the world, with a capacity of 1,300 barrels of flour per day, will be in operation in a few weeks. Of course cheap fuel is necessary to all manufacturing industries, and the saving in the use of natural gas is equal to 10 per cent. of the capital, when supplied at a merely nominal price.

"There has been a considerable advance in real estate prices, but the general tone is conservative. The holders of land have been made to recognize the fact that the expanding of prices beyond a certain limit is the most sure way to drive investors to other localities, and it might be added that at more than one good point values have tumbled 50 per cent., and even more, during the past few months."

There is always demand for the "best."

LETTERS FROM PRACTICAL MEN.

Vacuum Motors.

Editor American Machinist:

With reference to the absurd claim that a steam engine can be run with a tightly closed throttle, we are justified in assuming that there are no leakages, for the joints must be tight or the vacuum could not be maintained, even when the exhaust connects to a condenser in which is a vacuum of 26″. If there be not an ounce of steam and no provision is made to admit air, nature does not sufficiently abhor a vacuum to cause the atmosphere at normal pressure to penetrate cast-iron. How then can it be run by atmospheric pressure, since the air has no means of ingress to the cylinder? This is a conundrum, and I guess we will have to rely on "the unbalanced plenum" after all.

Gyascutus.

Crosshead Pattern.

Editor American Machinist:

With this I send a drawing of crosshead pattern, which, if you will kindly illustrate, may be of use to others. Figs. 1 and 2 show sectional views of the finished casting. Figs. 3, 4, 5 and 6, the pattern and core box.

Fig. 3 will be moulded in the cope, leaving its own core; *e* and *d* show two strips of wood to keep the sides in position, and must be stopped off in the sand.

Fig. 4 shows that part that will be in the drag. The core print is seen by the dotted line and projection below. The hub *A* is loose and held in place by dovetail *B′* also seen at *B*, Fig. 5. It will be seen that the wrist pin is to be cast in. Fig. 6 shows core box for one-half the core, and by changing the loose part *f*, which drawing explains it can be used for the other half of core. The hole for piston rod was bored from the solid metal.

Referring to Fig. 4, *e* shows a strip of hard wood extending across the width of pattern prepared to hold Fig. 3 in place instead of a pin as the other end.

William Newton.

Pitting in a Boiler, and How it was Prevented.

Editor American Machinist:

I saw an article in your paper about pitting in boilers. It is a serious question, but I believe I have devised a means of preventing it, and that I am doing no more than my duty in giving it to you, that you may spread the information where it may do the most good.

I set up a small upright boiler in a printing office in this place; the office was on the third floor, and they had nothing but pure rain water, which we decided was just the best water that could be used. But in less than two years many of the tubes began to leak steam through holes in their upper ends. These holes looked for all the world as though they had been drilled. A new set of tubes went the same way in about the same time, and then we decided that it could not be the acid used in soldering the roof, because the acid would have all been washed off by that time. We investigated, and found the roof had been soldered with rosin, and that, too, about five years before. But, somehow, the idea of acid kept in my mind, and sulphuric acid at that, but where could it come from? At last I made up my mind that all rain water is impregnated with sulphur, and in the process of boiling water to make steam, absolute crystals of sulphur would be formed on the surface, and would naturally attach themselves to the iron. Then the dampness and steam or sweat, when the boiler was not fired up, would cause corrosion to take place where the sulphur crystals had deposited themselves, the iron and sulphur together forming the best possible agency of destruction to the iron, viz., sulphuric acid.

I had taken boilers apart that were nearly filled with lime, and never saw the sign of a pit in them, and I reasoned that it was the absence of lime in this boiler that allowed the sulphur to eat up the iron, and suggested that they throw a lump of lime in the tank from which they took the feed-water. This was five years ago, and the tubes are all right yet. Of course the single dose of lime did not do it all. About once in three months they throw in a little fresh lime, say four or five pounds in a twenty-barrel cistern. We do not see any lime about the boiler, but we do see good results from its use.

Lime seems to be the great terror of all boiler users, but I believe it to be a blessing in disguise, and were there none at all in the water used in boilers, that boilers would hardly last long enough to pay for having them built. Of course an excess of lime is too much of a good thing, but just enough is the salvation of boiler tubes.

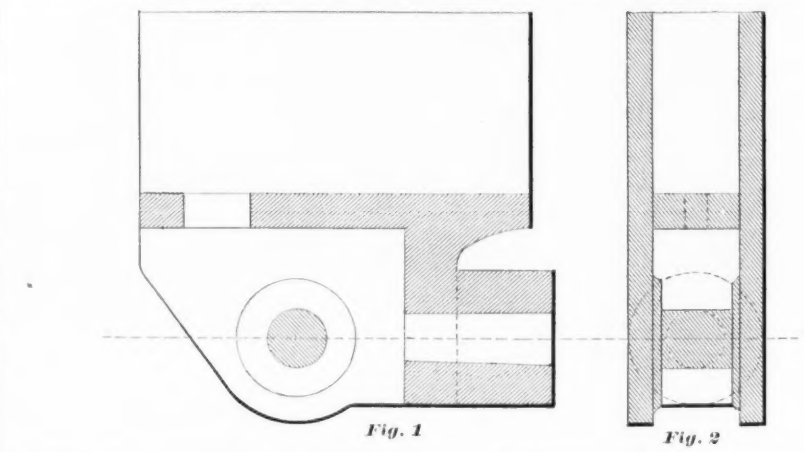
Le Roy Tobey.

Penn Yan, N. Y.

Round House Repairs and Round House Foremen.

Editor American Machinist:

For some years I have watched with a great deal of interest and concern the different methods of doing the running repairs on locomotives, the kind of work needed and the kind done, observed the kind of men in charge and imagined the kind of man I should prefer. I am thoroughly satisfied that great damage is done to locomotives while undergoing slight repairs in the round house. Certainly a set of side rods had better stay up than be taken down and filed by a blunderer who takes off lots of brass and puts them up badly and fails to secure a good fit in the strap, fitting so that it will be impossible to properly key the brasses up brass-and-brass without springing them; yet this is done very often.



Crosshead Pattern.

The lining up of crossheads is another much neglected piece of routine round house work; on engines having the four bar guide and long connecting rods this is not noticed, but on heavy consolidation engines using beam guides and a very short main rod it is a tri-weekly job, and many round house mechanics there be who never seem to think that the middle of that guide wears the most. The ends only receive the wear of a small part of the gib, while the center is rubbed by its entire length, and the center is called on to take the strain when the work is thrown on it by the angularity of the rod. To line up this class of crosshead properly the back end of the rod should be taken down and the crosshead pinched over the guide to see that all is right. Then the round house man should be careful to take the striking points and see that the piston travels in its proper place. Putting the liners back where he got them is like a manufacturer putting his own name on another man's work supposing it is all right. The last man who lined up the crossheads on my engine forgot to punch holes in the tin liners under the oil cups.

Calking flues that only simmer a little and do not actually blow is—in my estimation—bad practice, as the more flues are pounded or rolled the thinner and weaker they get, and as half of this kind of leak is caused by sudden cooling they will generally take up again with a hot fire. These and the thousand other little jobs that must be done should be done carefully, as to detail, and supervised by a man who knows what should be done and how to do it—a hybrid—cross between an engineer and machinist, a man who has had experience both in the shop and on the road. Let's take a look at him. He should not be made of pride, arrogance and ignorance, and should be a pleasant man who enjoys the confidence and respect of the engineers and firemen, and the machinists and wipers under him. He should not be the man who refuses necessary supplies to engineers simply to show his authority and appear economical, but should see to it that every engine is supplied with all tools, etc., and kept so. Where engines run, first in, first out, and he has the marking out to do, he should be noted for his fairness and ability to sit down on schemers, and live up to any agreement the engineers may have with the company. He needs to be mechanic enough not to put a machinist to packing driving-box collars while a helper is filing brasses. He should know the annoyance, delays and danger of running engines in need of certain repairs, what must be done, and what can be left undone, if such there be. He should recognize the fact that a fireman is a man, as well as the other fellow, have no pets, but lots of friends, and a few real live enemies. I never knew a man who had no enemies to make much of a success but as a successful failure. Now, if he is this kind of a man, he knows that it is not important that he merely get the engines wiped and the work off the book, but that every machine is ready to pull a full train safely, and with some degree of comfort to her crew. That is what they are built for. It should be as much his concern that the engines steam well, and do not run hot, as the engineers' who run them; and if under his care engines stay out of the back shop longer than usual, he should receive some of the credit, as he deserves it.

But if I keep on as if I knew all about this foreman business, I will get mail orders for a few dozen of them. Since the publication of the article on the Promotion of Firemen, I have answered no less than thirteen communications on the subject; some came through the American Machinist, and more came direct to me, which shows at least that the said American Machinist is read from Brooklyn to Portland, and from St. Paul to El Paso, for I got letters from each of these points.

A few years ago I enjoyed the proud distinction of being night round house foreman *pro tem.*, while a youthful machinist was East to get married, and honeymoon around, till the worst of the winter was over. We were located over 10,000 feet above the sea, in the great Rocky Mountain range; we had a small wooden round house, and no machinery; we had seventeen consolidation engines doing extra heavy mountain work, and all the snow you could wish for. These engines ran all day and laid up at night. They used the purest water on earth and were not washed out from the time they came from the back shop till they went back, yet they very seldom leaked. We had flue expanders, etc., but no regular boiler maker. The fires were never drawn unless we had repairs to make that would require the blowing off of steam pressure. We had two machinists, three helpers, and a thing (that was me.) When one of these engines had worried four or five cars up a dozen miles or so of mountain grade, over 200 feet to the mile, she backed down the mountain side for more cars and was held by the water brake, and this usage was hard on the machinery everywhere and few were the nights when there were not reports on most of the engines for work to be done that let us inside; the boiler shell, water-brake cocks, three-way cocks, gauge cocks, injectors, throttles, checks, etc., were leaking and must be ground in. Now, as we could use but five stalls of our house it kept all hands rushing to get them in, steam off, repairs done, and steam on, and out again, and the last few to come in did not always get there. Now, we had a good store house full of all these fittings, and we soon fell into the habit of putting in new cocks for leaky ones, new air pumps on in place of those played out, and new injectors for those that failed to work; the same with checks, etc. In this way the engines were soon out, and early in the night we had everything ready for the road, and the cocks, pumps, injectors, etc., to grind in, clean up, and put in stock at our leisure, and it then occurred to me that this plan on a more extensive scale would be no bad scheme in general use. It would allow one great shop to build all the work, and the small places to put it up.

Why not have a standard for all sizes of cocks, pins and bushings, and work to a greater extent on the replacing, and not the repairing principle? It certainly would be a saving to roads short of power. Stacks, sand-boxes, head-lights, ash-pans, rod brasses, pistons (except rings), all brass fittings, link gear, etc., can be done this way, and the necessary repairing work done in dull hours. This plan could be carefully elaborated so as to turn each pin and bushing just so many times, and so much, before it went to the scrap heap. But what might be a good scheme here might not be some place else, and perhaps I am like the man who would revolutionize the world to suit the whims of his own household.

John A. Hill.

A Vacuum Joker.

Editor American Machinist:

Of course an engine can be run by a vacuum, and if you put the vacuum on both sides of the piston at the same time, the engine will run both ways at the same time.

Have you never heard of an engine breaking down because the vacuum got in the crank-pin? Mechanical Engineer.

Reversing in Foundries.

BY DAVID SPENCE.

Reversing in foundries is not done as much now as in years gone by. At one time it was extensively done in stove plate foundries, and it is a cheap way of getting an iron pattern from a wooden one. And for the benefit of those who have not seen the like done in a foundry, I will try and give a plain description of the practice. In the first place, the mould board, or match board, as some term it, is made, and the pattern placed on and made fast to the board. Then whatever thickness you require your casting to be is put on top of the mould board and tacked down. The mould board should have pins on it, just the same as the cope of a flask. Then the drag is put on, and the sand riddled on the pattern. The drag is rammed up just as hard as it can be rammed, then turned over and the pattern drawn off from the drag. Then take good hard wood charcoal and fine parting sand and dust them on the mould. Put on your cope and ram it up in the usual way. Take off your cope and finish that part of your mould. Then shake out the drag that was rammed up hard; take off the thickness that was put on the mould board and ram up your drag as usual. Then turn over and draw off the pattern and finish the mould ready for casting. This practice in foundries is a good way to get plates straight and of even thickness, as only one side of the pattern requires to be made by the patternmaker. For instance, when a large stove door is to be reversed, the carving has only to be done on one side of the pattern. A moulder that is a good hand at reversing receives good pay in a stove foundry. It is a cheap way of making soap kettles, as all you require is a block of wood the size you require your kettle to be. In moulding soap kettles in this way you require to cope out your core. Figure 1 shows the block or pattern; Figure 2 the bottom board. *A* represents the thickness on the bottom board; *B* the flange for resting the kettle on the brick furnace when in place ready for use.

Four Hundredth Anniversary of the Discovery of America.

We have received a large envelope marked "Personal and Important," containing a pamphlet addressed "To the Editors of the Press of the United States," written in advocacy of the project of holding a great World's Fair in New York city in 1892, as a fit method of commemorating the four hundredth anniversary of the discovery of America by Christopher Columbus. The pamphlet is signed by William Euclid Young, secretary, and appended is a foot note describing Mr. Young as a "member of the New York Stock Exchange since 1869," and referring, as to his ability to promote so large an undertaking, to all the banks of New York city, and to the 1,100 members of the New York Stock Exchange.

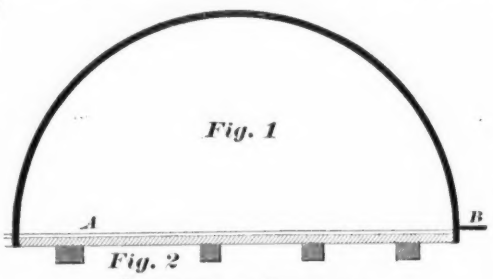
Though there has been rather a surfeit of exhibitions during the past few years, the four hundredth anniversary of an event so important would certainly seem to call for some notice. But the day has gone by when a commercial bazaar of whatever magnitude can be relied upon to provide attractions for a World's Fair lasting six months, and really worthy of the name. The true basis upon which such an exhibition must rest, to be successful, is and must be industrial in its nature. For this reason, while we wish well to the project, we are inclined to think the organizer of an industrial enterprise of this magnitude will require backing somewhat more potent than even that of the New York banks and Stock Exchange.

Speaking of Christopher Columbus and the discovery of America we might add, as an interesting incident narrated in a recent book of Spanish travel, that an American visiting Palos, the now ruined town from which Columbus set sail on that eventful voyage, found in the tavern where he stopped near that place, a full equipment of American-made furniture. The traveler thought it a very happy, if somewhat meager return, on the part of America, for the part played by Palos in the great drama of 1492.

There Was Something Lacking.

The Newcastle *Chronicle* says:

"The *Iron and Coal Trades Review* quotes from a North German paper a rather good story. It says that a German manufacturer had his boiler inspected, and the inspector entered in the record book a statement that everything was in order, and he added



REVERSING IN FOUNDRIES.

'boiler scale is absent.' The book was sent to the police office, and returned through an officer, who gave the message to the manufacturer that everything was in order except that the scale was absent, but he hoped the manufacturer 'would procure the scale as soon as possible, and so avoid further annoyance!'"

Automatic Centering Attachment.

The engraving shows a plan view of a centering attachment for drill presses, made by Sterling Elliott, Newton, Mass. The manner of attaching to column and of centering and holding the work is clearly represented. The attachment will hold round stock, up to $2\frac{3}{4}$ inches diameter, and square stock of the same size, centering the stock with the drill spindle.

The attachment shown will fit any of the drill presses previously made by Mr. Elliott, and attachments will be furnished for any make of drill press or lathe.

According to the *Sunday Herald*, the younger Vanderbilts have decided to erect fifty houses on Staten Island, which they will offer for sale on a novel plan that is intended to be beneficent without any flavor of charity. The houses are to be sold at cost, and paid for by the purchaser in yearly installments. Included in the selling contract is a plan for practically insuring the life of each purchaser, to the extent of the unpaid balance of the purchase price. If the head of the family dies before the payments are completed, the house is to be deeded to his family without further payment. Of course, in estimating the cost of the

QUICK-ADJUSTING CALIPER.

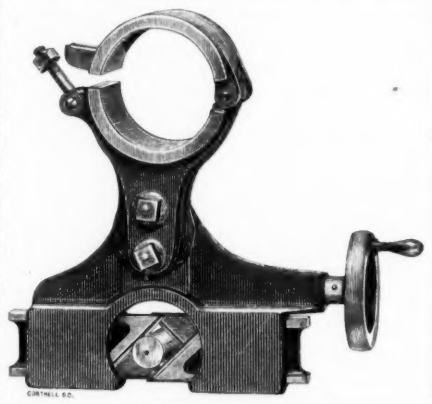
fifty houses, allowance is made to add a reasonable percentage to cover such losses on the part of the builders. In effect, the operation of the plan is to cause the fifty purchasers, through the co-operation of the Messrs. Vanderbilt, to mutually guarantee each others' families against losing their homes, and the advance payments made on them, through the death of the head of the family.

Those mechanics and engineers who have in the past asked for the adoption of the United States standard screw thread, and have sometimes been discouraged at the slow progress, will be interested in a statement by the Pratt & Whitney Co., the largest manufacturers of taps and dies in the United States, that 90 per cent. of their sales are of standard threads.

The Nashville Land Improvement Company is circulating a pamphlet descriptive of West Nashville, and setting forth the purposes of the company. The pamphlet contains a map of Nashville and West Nashville. The last named place is on the banks of the Cumberland river, three miles from Nashville, Tenn. So far as we can judge by the names and standing of the gentlemen connected with the enterprise as directors it is a genuine effort to build up a manufacturing city in an excellent location. We see by the pamphlet that good inducements are offered to manufacturers to locate, and that the intention is not only towards good manufacturing facilities, but also towards making the town otherwise pleasant as a place of residence.

Quick-Adjusting Caliper.

The construction of this caliper is well shown in the engraving. By pressing the bows inwardly just sufficient to overcome



AUTOMATIC CENTERING ATTACHMENT.

the tension of the spring and relieve the pressure against the nut the latter is freed from the thread and can be instantly moved to any desired position on the screw, then by releasing the pressure on the bows the beveled end of the washer is forced against the corresponding inside bevel on the end of the nut; this straightens the nut on the screw, locking the threads as shown in the detached view. The nut can then be used for the necessary fine adjustment as if it were of the ordinary construction. The nut, as will be seen, is in one piece, and hence not subject to derangement.

The Wright Machine Company, Worcester, Mass., manufacture these calipers.

When the Canadian Pacific Railroad was built it was under a charter guaranteeing that no right should be granted to build competing lines within a certain distance. As might have been expected this does not work well in practice, the settlers in Manitoba and the Northwest in particular severely criticising the Government for aiding in establishing a monopoly.

Bradstreets says that the capacities of the cut-nail industries are in excess of the demands. Wire nails are having a good deal to do with it.

Trains on the Glasgow Underground Railroad are very successfully lighted by electricity.

Literary Notes.

The Annual Statistical Report of the American Iron and Steel Association for 1886, just issued, contains full, complete and reliable tables of the production of 1886 and previous years, with a short review of the present condition of the iron industry in foreign countries. It is more interesting them usual, inasmuch as the production of iron last year was much the largest in our history, and every ton of iron and steel produced went into consumption. An extra large quantity of iron was also imported and used. Prices are now higher than they were last year and the production promises to exceed, this year, the remarkable production of 1886. The author says:

"No man knows how long the extraordinary demand for iron and steel caused by the present activity in railroad building and railroad betterment will continue. The present year seems to be secure. Beyond it, and may be before its close, we have the evil of over speculation and the practical working of the Inter-State Commerce Act as possible reactionary elements. What this year's crops may be is another unknown element. One thing, at least, can be counted on with certainty; there will be no change in the tariff this year to injuriously affect the general prosperity."

The pig iron production in 1886 was 6,365,328 tons of 2,000 pounds. It had steadily declined from 1882 to last year. The production for 1885 was 1,638,803 tons less than for 1886. Of course Pennsylvania ranks highest, producing over one-half of the pig iron made in this country. Ten Southern States had furnaces and made iron last year. They produced 185,461 tons more than in 1885. Pennsylvania produced 847,793 tons more last year than in 1885. In the ten Southern States the increase was $24\frac{1}{4}$ per cent., while in Pennsylvania it was $34\frac{2}{3}$ per cent. This does not look like injurious competition from the South. In fact, most of the newspaper talk about making such remarkably cheap pig iron in certain sections as to drive out any of the Pennsylvania furnace owners is bosh. There is a good opportunity to increase the production of pig iron in the South, and it can all be sold and used in this great country without driving anybody out of business. The South will produce a million tons of iron this year. There are 577 good blast furnaces in the country. Bessemer steel boomed up 49 per cent. in 1886 over the previous year. It was made in nine States. Crucible steel also increased considerably. Open hearth steel increased its output 64 per cent. The total production of steel of all kinds in 1886 was not only the largest in our history, but it was the largest annual production in the history of any country. More nails were produced in the United States in 1886 than any year before. The production of wire nails this year promises to be a million kegs. The production of iron ore in 1886 is estimated at ten million gross tons.

A large number of iron and steel works are now building.

This valuable pamphlet is published by the American Iron and Steel Association, 261 South Fourth street, Philadelphia.

W. Barnet Le Van has reprinted his paper on "The Weakening of Steam Boilers by Cutting Holes in the Shell for Domes and Necks," read before the Franklin Institute some six years since. In this paper strong argument is made against the use of domes on steam boilers, the perforated dry pipe being preferred. The argument is interesting and the paper is really a valuable one. We do not know upon what terms this paper, which is fully illustrated, can be obtained; but a note addressed to W. Barnet Le Van, 3,607 Baring street, Philadelphia, Pa., will bring the desired information.

Milling journals note the fact that there is dearth of invention in the line of milling machinery, although there is ample room for improvement.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

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☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

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NEW YORK, JUNE 4, 1887.

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Territorial Limits of Natural Gas.

In our issue of March 20, 1886, we intimated, notwithstanding the confident expressions of scientific and other observers, who believed themselves well posted in the genesis of natural gas, and were disposed to localize its possibilities, that it was much too soon to settle on the degrees of latitude and longitude outside of which natural gas need not be looked for, with any expectation of finding it. Many circumstances have occurred in the fourteen months that have elapsed since that intimation was put in type, to show that the eager seeker after natural gas on general principles, or no principles at all, except to bore for it, was nearer right than the men of more scientific equipment.

Instead of being localized in a small central belt, about as the petroleum supply has been thus far, it seems likely that natural gas will ultimately be found to underlie a region almost or quite as extensive as that tenanted by bituminous coal. Places as far apart as Middletown, N. Y., Pittsburgh, Pa., Wheeling, W. Va., Findlay and Toledo, Ohio, Kokomo, Ind., Port Huron, Mich., Mattoon, Ill., and Paola, Kan., are already found to possess natural gas either in great profusion or in quantities worth looking after, while all indications favor an enormous spread of the natural gas epidemic South, as well as North and West. So much for present symptoms. The ultimate effect of the disease upon the manufacturing and commercial industries of the districts involved, remains to be seen.

One thing is likely, however, as to the future of the towns and cities which attract attention through possession of or nearness to an effective natural gas supply, and that is, the greatest benefit will most probably be realized in the race for manufacturing supremacy, by those places which, the gas conditions being equal, had the best start before its discovery and possess the greatest natural and acquired advantages in other matters.

Among these advantages may be named, pre-existing manufactures, opportunities for working people to obtain homes, accumulated capital, central location, water communication and railroad connections, with their corresponding facilities for obtaining ores and other raw materials, as well as of obtaining markets for their manufactured products.

One other observation may be noted. The more wide-spread the territory having available supplies of natural gas becomes, the less opportunity there will be to "corner" the price of the gas, as manufacturers seeking locations will have more liberty of choice left to them. On the other hand, to whatever extent the price of the gas is pushed up, by just so much is its advantage over other fuels lessened.

Bridging the Hudson River.

The New York Board of Trade and Transportation send us a circular relating to the proposed bridging of the Hudson River between Albany and New York, and ask our assistance in preserving the usefulness of this great natural waterway.

We have previous to this expressed our opinion as to the inadvisability of permitting the construction of a bridge with piers below Albany. We believe it is the settled intention of railroad corporations to destroy the usefulness of both natural and artificial waterways, because they tend to cheapen transportation. The people are foolish to permit this, but all experience goes to show that they will do so. It is made for the interest, pecuniarily, of legislators to favor schemes of this kind, and money tells. We see no way to successfully oppose them except by a large expenditure in the contrary direction, which is not to be thought of.

We were conversant with the arguments that were used in favor of bridging the Hudson River at Albany and Troy. There was plenty of scientific opinion to the effect that bridges at these points would not impede navigation. While every man with a fair amount of common sense knew these representations to be false, their opinions had no effect. The result is apparent. Bridges below Albany would, of course, be detrimental in a still greater degree.

We sympathize with the Board of Trade and Transportation. Their efforts are not only in the direction of the interests of New York, but they are in the interests of nine-tenths of the people in the country. But how is this association to counteract the influence of gigantic railroad corporations? We acknowledge that we cannot say.

We recently published two letters from Egbert P. Watson, the first criticising the plain statement of a simple fact made by one of our correspondents, and the second taking exceptions to the course of the AMERICAN MACHINIST in endorsing the views of that correspondent. The second of the letters referred to was received after more than matter enough—of greater value—was in type for our next issue, and, exactly as would have been done with any matter of neither especial nor immediate importance, it was laid by for one week. During this interval of one week Mr. Watson published a statement to the effect that we had refused to publish his second letter. This statement was and is unqualifiedly false. Mr. Watson received no intimation from this office that his letter would not be published, and moreover, he could have satisfied himself upon this point at any reasonable time within five minutes. His published statement was not only false, but has all the appearance of being maliciously so. At the time he made it public the presses were at work on the edition of the AMERICAN MACHINIST containing word for word the letter in question. In view of the falsehood described above, we shall publish nothing further from Mr. Watson, upon any subject whatever.

The Other End of the Boycott.

According to a recent press dispatch a large number of contractors and manufacturers connected with the building trades in Chicago have entered upon a line of action which may be characterized as a resort to the other end of the boycott.

Hitherto that very clumsy and not very potent weapon has been mainly used to thwart the purposes of sellers. In the instance referred to it appears to have been adopted for the avowed object of thwarting the purposes of buyers. A few contractors in the city, who are not members of the Builders' and Traders' Exchange, having made concessions to their men which are not agreeable to the members of that body, the concerns connected with that organization have agreed not to sell them any building materials, and will by this means endeavor to prevent them from completing their contracts.

We are not of opinion that the butt end of the boycott will prove to be any more just or legal than the other end.

Every Man to his Trade.

Recently an enterprising individual sent us a patent medicine advertisement for insertion in the AMERICAN MACHINIST, which was as usual promptly declined. A day or two since he returned to the attack with a vigorously argumentative attempt to convince us that it was our duty to accept the order in the interest of suffering humanity. His letter says:

It certainly cannot be that you would decline to lend your aid to the sick and suffering, by inserting an announcement of the way to strength and happiness. Such a course is certainly not in keeping with the office of a newspaper such as yours. It ought not to be, that the well being of perhaps thousands should be sacrificed to elegance in the make-up of your paper. While it is your privilege to take a contrary view of the situation and act up to it, if you see fit, yet there can be no justice in it.

To this moving appeal we replied in substance, that we had in the beginning deliberately chosen our field, which is mechanical, and not medical. While some of the patent medicines we were asked to advertise might be useful remedies, we had no means of discriminating between such and the quack nostrums with which our columns would be flooded, if we once "let the bars down."

In denying the force of such appeals to philanthropic considerations, we do so fully mindful of the value and importance to thousands of readers of the work we set out to do and shall confine ourselves to doing. It is our belief that every man should stick to his trade, and that the proprietor of a machinery establishment, for example, would be wofully in error, who should step aside from his legitimate field, and take in jobs of shoemaking or bread mixing, simply because somewhere individuals are suffering from lack of shoes or bread.

Personal.

Robert W. Gardner, inventor of the Gardner governor for steam engines, and president of the Gardner Governor Company, of Quincy, Ill., paid us a pleasant call a few days since, on his way to Europe, where he proposes to spend a well-earned vacation in travel. When distinguished foreigners come to this country Americans always make it a point to be good to them, especially if they have handles attached to their names. By way of reciprocity, we do not mind hinting to our transatlantic cousins that Mr. Gardner is a good deal more of a success as a governor, than are most of the occupants of gubernatorial chairs in this country.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(240) T. S., Knoxville, Tenn., asks: How are flat irons ground and polished? Can they be polished on a rubbing bed such as is used for polishing marble, or are surface grinders the best for the purpose? *A.*—Flat irons are polished on emery wheels, and we believe these are the best for the purpose.

(241) H. G., Kennebeck, Me., asks: How can I make brass retain its color? On my steam gauge and injector valves I use Tripoli and mineral paste for scouring, and in about an hour it turns dark. Is there anything to prevent this? *A.*—No. If you have your brass goods lacquered, they will retain their color unless you scour off the lacquer, which you are likely to do.

(242) R. L. D., Atlanta, Ga., writes: In the *Railroad Gazette* of February 25th, 1887, is a diagram of a valve motion belonging to engine 132, running on the Old Colony Railroad. It is stated that on notch 1 the lead is 1-32 of an inch, and in mid-gear the lead is ¼ of an inch. Please explain how the lead becomes greater in mid-gear than in full gear. *A.*—See AMERICAN MACHINIST, April 30, 1887, page 5, and also November 20, 1886, page 6.

(243) J. B. R., Helena, Ark., writes: Enclosed find pieces of metal taken from a broken link. Please tell me if it is iron or steel, as there is a controversy about it. *A.*—It is steel. 2. How large should a bar be to hold 5,000,000 lbs.? *A.*—Before this question can be answered you must state the conditions under which the bar is to hold this weight, and whether the bar is subjected to a steady stress or shocks; also mention the materia of which the bar is to be made.

(244) C. H. M., Philadelphia, Pa., writes: In J. G. A. Meyer's article, Vol. 10, No. 20 and Fig. 203, he says that if the distance r s is greater than s_2 t, then the eccentric rod is too long, and must be shortened to make travel equal. I think that the rod should be lengthened to accomplish the purpose; if I am wrong, I would like to know it. *A.*—You are right. In place of the word "greater," the word "less" should have been used; in the second line below in the same sentence read "greater" in place of "less."

(245) W. W. asks: What is the benefit of putting a piece of lead in a newly-daubed cupola? *A.*—We have submitted this question to Thomas D. West, who replies as follows: "I know of no benefit other than that throwing a piece of lead into liquid iron has an enlivening effect. In newly-daubed ladles, should they not be quite dry, there is always more or less 'boiling' of the metal, and there is sometimes a cooling effect from throwing in the lead; this may tend to allay the ebullition."

(246) Baltimore—Will find articles on screw cutting in the AMERICAN MACHINIST of April 4 and June 13, 1885, from which he can get the answers to his questions.

(247) J. H., Ill., asks: Will you inform me where I could get a book that treats on laying out work for locomotive boilers? *A.*—The manner of laying out the principal sheets of a locomotive boiler has been explained in the AMERICAN MACHINIST, April 17, 24, June 5, 12, August 7, 21, 28, 1886. Also see answer to question 231 in the AMERICAN MACHINIST, May 21, 1887.

(248) B. R., Montrose, Pa., writes: We have purchased a pump which does not work satisfactorily; whether it is with the setting of the pump or not we have not decided, and would like your opinion on it. The pump is run by a belt about 58 strokes per minute; barrel and plunger about 5 inches, and is piped with one-inch pipe. You will see by the following rough sketch how the pump is piped. Do you think it needs an air chamber, and where would you put it if it does? It has no air chamber at present. *A.*—Use an air chamber and place it on the delivery pipe as close to the pump as possible. Your sketch is not very plain; from the appearance of your sketch it would seem that the suction pipe is in the wrong place.

(249) A. L., Milwaukee, Wis., writes: In an evaporating apparatus which I am arranging, it is necessary to admit steam directly in order to quickly separate certain volatile fluids from a mixture with less volatile ones. Leached bark shavings are used as a steam-generating fuel, which produces wet steam, probably by reason of its comparative low heat of combustion. The moisture carried with the steam is quite objectionable, since it condenses in the apparatus, and thus prolongs the steaming process, which must leave the remaining product pretty dry. I am therefore in search of an apparatus which is of comparative low cost, and which is capable of separating a large quantity of moisture contained in the wet steam. *A.*—From this meager description of your apparatus, we can make only the following suggestion—that is, pass the steam through a coil of pipes placed in the furnace of the apparatus.

(250) H. S. Kokomo, Ind., asks: Which is the proper way to put up a lead [steam] pipe—pitching towards the engine or towards the boiler? *A.*—The opinions of engineers differ on this question. Our preference is to give the pipe a pitch towards the engine. 2. My steam gauge is connected to the dome of boiler, and it frequently fluctuates several pounds. What is the trouble? *A.*—When the engine takes steam from the dome, the pressure there is momentarily reduced; this is magnified at the gauge, owing to the inertia of the moving parts. Connect your gauge to the shell, as far from the dome as practicable. 3. Of two boiler settings, one filled in back of bridge wall and the other left full depth, which will show the best economy? *A.*—There is very little difference. A good plan is to fill up to within about 20" of boiler, so as to leave room for inspection. 4. Should a bridge wall be built straight across, or circled to the boiler? *A.*—Our experience is that a straight bridge wall is as good as any, and easier to build and keep in repairs.

(251) H. H., Albany, N. Y., writes: I am building a small steam engine—cylinders, 3"x3"; steam ports, 1¼"x¼;" exhaust port, 1¼"x⅜"; bridges, ¼". 1. How much throw must I give the eccentrics? *A.*—You do not state the amount of lap, but we shall assume it to be 3-16", which will allow the steam to follow the piston through ⅞th of the stroke very nearly; the throw of the eccentric should be 1 inch; that is, ½ of an inch from center of shaft to center of eccentric. 2. How long should the slot of the link be? *A.*—About 3½ inches. 3. What must be the size of the steam and exhaust pipes? *A.*—Steam pipe about 11-16" diameter; and exhaust pipe, about 13-16" diameter. 4. When the engine is on top center, to what angle shall I set the eccentric? *A.*—Set the eccentric ahead fully 3-16"; that is, set it ahead equal to the lead and lap.

(252) G. C. M., Athens, Ga., writes: I desire to get your assistance in solving a problem I came across the other day in locating the ball of a safety valve for different pressures; there is one part of the problem I could not work out with anything I had at hand, and that was finding the center of gravity of the lever. The problem runs thus: Weight of ball, 100 lbs.; weight of lever, 10 lbs.; weight of valve, 2 lbs.; diameter of valve, 3 inches; and the fulcrum is 5 inches. Now what I would like you to answer is, How is the center of gravity of the lever obtained? *A.*—You do not give us the length of the lever or its shape, and therefore we cannot give the mathematical rule that will apply to your case; the shape of the lever, in particular, is an item that must be known; the lower edges of some levers are curved, in others they are straight, and a rule that will apply to one will not apply to the other. But you can always find in a practical manner the center of gravity of the lever in the following manner: Suspend the lever so that it will remain at rest in any position in which it may be turned; the point from which the lever is suspended will be the center of gravity of the lever. Or simply balance the lever on some sharp edge; the distance between this edge and the end of the lever will be the distance between the center of gravity and the end of the lever.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gear Wheels. See Geo. B. Grant's adv., p. 16.

To Let—Part of large store. 43 Dey st., N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Edw. Sears, Wood Engraver, 169 William st, N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Air Compressors, Rock Drills. J. Clayton, 43 Dey st., NY

Exhaust Tumbl'g Bbls. Henderson B's., Waterb'y, Ct.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

Robbs' Patent Composition for case-hardening. Send for circular. F. W. Tasney, Paterson, N. J.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Extra capacity, hollow-spindle Hand Lathes; correspondence solicited. J. R. Rand, Brattleboro, Vt.

20", 25", 28" B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Ice and Refrigerating Machines. 124 built, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N. Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See May 21, p. 13. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

Patents, American and Foreign, promptly procured and sold on best terms by Jas. H. Lancaster, patent attorney, 187 Broadway, N. Y., and London.

Small Machine Shop Plant for sale; best of tools up to 50"; building can be rented low. Address Chs. W. Griggs, Dearborn and Monroe sts., Chicago, Ill.

Pump Catechism (by Grimshaw, new edition). Tells how to adjust and run every leading pump in use. $1.06 post paid. Practical Pub. Co., 7 Dey st. (Room A), N. Y.

New Book on Gears; Tables giving 3,094 diameters, with rules for calculation of movements of shafts, etc.; sent on receipt of P. O. Note; price 50 cts. Address C. B. Long, M. E., Worcester, Mass.

Reed's Engineer's Hand-Book to the Local Board Examinations. Eleventh edition revised and enlarged, with 260 diagrams and 36 large plates. 8vo., cloth, $4.50, post-paid. Catalogue of books free. E. & F. N. Spon, 35 Murray st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

MANUFACTURES.

Water works will be built at Beaumont, Tex.

Water works are to be built at Washington, Pa.

Citizens of Oxford, Ala., are agitating for a cotton factory.

W. J. Hany will build a sash and door factory at Gallatin, Tenn.

A. Stemez will build a factory at 30 Bedford street, Newark, N. J.

The Gallatin (Tenn.) Chair Factory will build new and larger works.

The Annis Cotton Mill Company propose building at McMinnville, Tenn.

Allen & Robinson are building a shingle and lathe mill at Isbell, Ala.

A four-story brick shop is to be erected at 35 and 37 Rutgers street, New York.

Susholtz, Myers & Co. contemplate building a knitting mill at Amsterdam, N. Y.

The Alexander Iron Company are to erect malleable iron works at Nashville, Tenn.

A grain elevator will be built by the Morristown Mill Company, at Morristown, Tenn.

An addition, to be used as a machine shop, is being made to the E. W. Chapin Mill, Northboro, Mass.

A two-story mill will be built by J. C. Beatty at the corner of Pearl and Seventh streets, Camden, N. J.

The Auburn Bolt and Nut Works propose to start in business at Auburn, Pa., with a capital of $30,000.

The Hiram Holt Company propose to embark $100,000 in the manufacture of hay knives at East Wilton, Me.

The Rogers Foundry, at Belleville, Ill., is to be materially enlarged. Several more moulders will be employed.

A company is being organized to build a cotton factory at Union, S. C. T. L. Harnes can give information.

The sum of $25,000 has been raised in Fairfield, Iowa, to be used in assisting manufacturers in locating there.

Riter & Conly, Pittsburgh, Pa., amongst other specialties, manufacture foundry ladles to pour from the bottom.

The N. O. Nelson Manufacturing Company, of St. Louis, Mo., have taken the agency for the Dodge split pulley.

The Pittsburgh Electrical Motor Company is the name of a company organized in Pittsburgh, Pa., to construct electric motors.

The M. C. Bullock Manufacturing Company, Chicago, Ill., have removed their offices from 158 Lake street to 138 Jackson street.

The Erie (Kan.) Board of Trade, recently organized, invite correspondence from parties looking for manufacturing locations.

An iron and brass foundry is to be built at Plaquemine, La. The title is the Plaquemine Iron and Brass Foundry Company.

The Reliance Wire Company, of Milwaukee, Wis., is the name of a new company that proposes to manufacture and deal in wire goods.

Hollow ware and enameling works are to be erected at Birmingham, Ala., by the Birmingham Hollow Ware and Enameling Company.

The Robert Aitchison Perforated Metal Company, of Chicago, are furnishing perforated steel plates for the new Pension Building at Washington.

The Murray Foundry and Iron Works, Burlington, Iowa, recently destroyed by fire, were the largest in the State. They will be rebuilt at once.

The Dennison Manufacturing Company, Mechanics Falls, Me., have fair prospects of putting their paper mill in condition and starting up soon.

The Hart Manufacturing Company, 120 Public street, Cleveland, Ohio, are manufacturing adjustable dies and stocks for machinists and blacksmiths.

Isaac Proutz & Co. are building an engine and boiler-house at Spencer, Mass. It will be occupied by 320 horse-power in boilers, and a 250 horse-power engine.

The Bethlehem (Pa.) Iron Company are at work on their new plant for steel forging and armor plate, preparatory to beginning work on their large Government contract.

Mr. Marshall, of Steut & Marshall, Knoxville, (Tenn.) has organized a company to build an organ factory. Ground has been purchased.—*Manufacturers' Record.*

George Innes, president of the Lawrence (Kan.) Board of Trade, is desirous of establishing a woolen mill at Lawrence. It is understood that he controls some valuable patents.

A sufficient amount of stock has been subscribed to insure the erection of a $100,000 cotton mill at Jackson, Tenn. It is intended that the mill shall be ready for the next cotton crop.

The Champion Blower and Forge Company, Lancaster, Pa., have added to their business the manufacture of a full line of power blowers, exhaust fans, stationary forges and tire benders.

Ground has been broken at Findlay, Ohio, by the Findlay Iron and Steel Company. Small iron forms and horseshoes will be made. The location of the company was decided by the supply of natural gas at Findlay.

Jenkins Bros. have taken the general agency at New York and Chicago for reducing valves, regulators, fire sprinklers, and other steam specialties made by the Mason Regulator Company, of Boston, Mass. New York office, 71 John street; Chicago office, 54 Dearborn street.

Bradley & Co., manufacturers of steam hammers, forges, etc., Syracuse, N. Y., announce that they have removed their branch office in New York city to 32 and 38 College place, corner of Murray street, where, with enlarged quarters, will be kept on hand for immediate delivery a full line of their manufactures.

Ferris Ogden, a mechanical engineer, located at Mansfield and Mount Vernon, Ohio, who has been an occasional contributor to the columns of the AMERICAN MACHINIST, has purchased the machine and foundry plant of the Council Bluffs (Iowa) Iron Works, and is equipping it to do an extensive business in steam engines and general machinery.

Aitchison & Little, Cleveland, Ohio, have issued a handsomely-illustrated and printed circular of passenger and freight elevators built by them. It contains illustrations and descriptions of hydraulic, belt and hand-power elevators, together with safety and other details; also useful hints on the location of elevators and other handy data of a general character.

The Worcester Machine Screw Company, Worcester, Mass., have provided a new circular and revised price-list of set screws, cap screws, studs, machine screws, taps and other specialties. They write us: "We are quite busy in all departments of our works. We are increasing our facilities as fast as possible, and at present time are able to fill orders promptly for all standard goods."

The Beaver Falls (Pa.) *Tribune* is authority for the statement that arrangements are completed for building a machine shop and foundry at that place. The stock in the company is principally held by manufacturers in the place. The machine shop will be 50x100 feet; pattern room, 32x50 feet; foundry, 50x100 feet; coke-room, 16x32 feet. It is expected to push the buildings to completion within three months.

A movement is on foot to introduce water motors in Lowell for use in small factories. It is alleged that a large number of small manufactories are kept from Lowell by reason of the cost of coal, water and other necessaries. The cost of engines, boilers, etc., has deterred many inventors from developing their schemes, and deprived the city of increased population and wealth. Enough water runs over Pawtucket Falls at waste to run quite a number of small manufacturing establishments and motors.—*Manufacturers' Gazette.*

Pedrick & Ayer, Philadelphia, have issued the following circular to their employes under date May 16, 1887: "From June 1st to September 1st, 10½ hours will constitute a day's work, excepting Saturdays, when we will run from 7 A. M. to 1 P. M. continuously. Payments will be made for sixty hours' work. Hoping that the pleasant relations existing between us may continue, and that this arrangement may be mutually advantageous, we are," etc.

The following list of Buckeye engines has been sold at the Chicago agency: F. K. Stevens, 105 horse-power; the Van Nortwick Paper Company, of Batavia, 190 horse-power; the Wunder & Abbott Illuminating Company, one of 280 and one of 190 horse-power; Marshall Field & Co., two of 190 horse-power each for electric lighting; Chas. Whittaker Manufacturing Company, 50 horse-power; the Watertown Heating and Power Company, of Watertown, Dak., 46 horse-power; outfit—engine, boiler, pump and heater. All were of the Tangeye bed style except the 50 horse-power.

The Nashua Co-operative Iron Foundry Co. did a very successful year's business, and the coming year's outlook is very encouraging. This co-operative company shows what can be accomplished by good management and laborers working in harmony with their officers. The report shows the success of this company, which was for a time under the management of the late Major T. B. Crowley. It had its origin in an attempt to crowd the men by former employers in what was known as Otterson's Foundry. A six per cent. dividend was ordered paid, ten per cent. of the net earnings of the company were placed in the sinking fund, and about $400 is to be distributed among the men who have worked one year.—*Commercial Bulletin.*

The second of the Worthington high-duty pumping engines (illustrated in the AMERICAN MACHINIST of April 10, 1886) was built for the city of Montreal, and has been in use for some months. Recently an exhibition was given of its working, which, according to the Montreal *Gazette*, was very successful. The engine is pumping at the rate of 10,000,000 British gallons in twenty-four hours, the water being raised to a height of 200 feet. No duty test has been made, but in a speech made upon the occasion of the exhibition Alderman Donovan, of the Water Committee, pointed out that the new engine was effecting a large saving in the cost of coal. Several of the new type of engines have already been put at work, and others are building.

The old Westlake Rolling Mill at Warren is to be extensively remodeled by the new owners. Besides the improvements recently noted, we learn from the Warren *Chronicle* that a new 20-inch, three-high plate mill will be added south of what is now known as the "little mill." To run this a new engine, of from 450 to 600 horse-power, will be put in. For this mill a new building 70 feet wide and about 200 feet long will be built. Furnaces will be put in which will have the capacity of 32 single furnaces, such as are now in the mill. This will give the mill a capacity of 75 tons a day. The furnaces will be arranged to use gas, either natural or that made by themselves. The battery of boilers will be placed east of the present buildings, and several new steel boilers added to the present battery. It is estimated that $65,000 will be put into the mill by the time it is completed.—*Western Manufacturer.*

The Springfield Foundry Company, Springfield, Mass., is contemplating still another addition to its plant, the moulding and core-rooms being overcrowded. To obtain the needed space, it intends to erect a building to contain the cleaning, annealing, finishing and japanning departments, boiler and engine-rooms, office, pattern and warerooms, and use the present foundry building entirely for moulders and coremakers. The new building will be equipped with the most approved appliances, and the company will then have ample facilities for the production of fine castings of all descriptions, iron and brass. The company this spring established a Boston office at 141 Milk street, to accommodate its increasing trade in that vicinity, the agent in charge being Homer F. Livermore, who has had considerable experience in the manufacture of castings and hardware.—*Boston Journal of Commerce.*

B. Driver will start a carriage factory at Owensboro, Ky.

A water company has been incorporated to build water works at Stevens' Point, Wis. W. H. Fritchman, of New York city, is one of the incorporators.

The Spiral Weld Tube Company, corner Oak and Franklin streets, Greenpoint, L. I., is the name of a company formed to put on the market spiral welded pipe made according to patents granted to the late John B. Root. James C. Bayles is president.

The New York and New Haven Automatic Sprinkler Company send us their latest illustrated catalogue of fire extinguishing equipments, in which the advantages of their systems are very plainly set forth. The principal office of the company is at 317 Broadway, N. Y.

Machinists' Supplies and Iron.

NEW YORK, May 19, 1887.

The general course of machine business and the supply trade continues without noticeable change. Shops are generally well supplied with orders, and dealers report business as fairly active. There is the same complaint of low prices and small profits, and it looks as if this was likely to be the case until something approximating a boom gives occasion to advance prices.

Iron—The supply of American pig is fully equal to the demand, but furnacemen are not disposed to grant any concessions in price of standard brands. We quote: No. 1 X Foundry, $21 to $21.50; No. 2 X, $19.50 to $20; Grey Forge, $18 to $18.50.

Scotch Pig—Prices are stationary, with but little business doing. We quote: Coltness, $22 to $22.50; Gartsherrie, $21.50 to $22; Summerlee, $21.50 to $22; Eglinton, $20.50 to $21; Dalmellington, $20 50 to $21.

Antimony—Hallett's, 7.65c.; Cookson's, 9c.

Copper—The market is quiet. Lake is held at 10c., but bids are a little less. Other brands have sold at 9c. to 9¼c.

Lead—There has been considerable demand for a few days, mostly for speculative purposes. Prices have been from 4.50c. to 4.55c.

Spelter—5¾c. to 6c.

Tin—There has been light demands for jobbing lots. We quote Banca, 23½c.; Straits and Malacca, 23¾c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Leading position by first-class draftsman. Address Box X, AM. MACHINIST.

An experienced mechanical draftsman wants position. Address L. M. N., AM. MACHINIST.

Wanted—A thorough mathematical instrument maker. Address Box 1543, Philadelphia, Pa.

Six first-class machinists on engine work; steady employment given. Address Ottumwa Iron Wks., Ottumwa, Iowa.

A man with theoret. and practical experience wishes situation as designer or foreman of draw ing room. Address M. E., AM. MACHINIST.

Foremanship wanted by a competent and live machinist; 15 years' experience on general or special machinery; first-class references. Address Jig, AM. MACHINIST.

Wanted—Situation by an all-round machinist, six years in the shop, one year at Cornell University; can apply indicator; fair draftsman. Address C. L. H., AM. MACHINIST.

Wanted—Competent draftsman, experienced on general machine shop, blast furnace and rolling mill work; give references and state salary expected. Address Machine Shop, care AM. MACH.

A mechanical engineer and superintendent of long experience with steam and hydraulics, and general heavy machine work, is open for engagement; satisfactory references. Address D. E. H., AM. MACHINIST.

Wanted—Situation by a young engineer, A. M. I. C. E., well up in fast steam yacht and launch building, torpedo boat, yacht and launch machinery, drawing office and shops; long experience at a first-class firm in Great Britain. Address A. M. I. C. E., American Exchange, 449 Strand, W. London, England.

Machine shop foreman wanted to go South, accustomed to stationary engine work, general jobbing and steam fitting; must understand handling men to the best advantage, and be well advanced in modern machine shop practice; state wages expected and where last employed. Address Enterprise, AM. MACHINIST.

Wanted—In a light, clean manufacturing business for repairing machines in use, making new machines, designing and drafting. A good, steady place for the right man; only an excellent workman wanted; state age, present position and salary expected. Address George Gardner, 667 Sixth st., Detroit, Mich.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 25 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Stationary and boat engines, boilers; best made cheapest price. Washburn Engine Co., Medina, O.

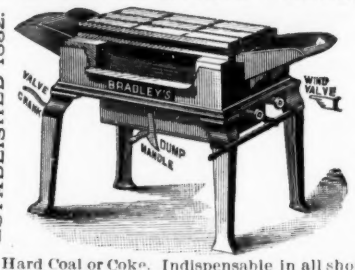
Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. I. A. Weston & Co., Syracuse, N. Y.

For Sale—Two No. 7 second-hand milling machines, in excellent order; made by "Brainard." Address Beaman & Smith, Providence, R. I.

For Sale—Low figure, in good order, four stationary engines—one each of thrty-five, forty, fifty and sixty horse-power. Address Pratt & Letchworth, Buffalo, N. Y.

Designs and working drawings prepared for every branch of mech. engineering; pumping machinery a specialty. A. C. Christensen, 26 Church st., N.Y. (late chief draftsman for Henry R. Worthington).

BRADLEY'S HEATING FORGES.

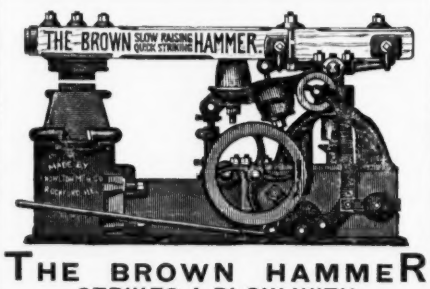


For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.



THE BROWN HAMMER
STRIKES A BLOW WITH
Double the Velocity That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., KING ST., ROCKFORD, ILL.

ONE-HALF TIME and LABOR saved by using this solid, strong, durable, firm-hold, quick working Lever (Not Screw) Vise. Has improved Taper-Pipe and other attachments. Sold by the trade. Send for circular.
TOWER & LYON,
95 Chambers Street, New York.
Successors to MELVIN STEPHENS.

American Twist Drill Company's
PATENT CHUCK JAWS.

Three sizes. Price per set of 4 Jaws, $40, $48, $56. Bolted to lathe face plates, they make best and cheapest chuck in the world. Address orders, Laconia, N. H.
HILL, CLARKE & CO., Boston and St. Louis.
MANNING, MAXWELL & MOORE, N. Y. City.
TALLMAN & McFADDEN, Philadelphia, Pa.
or WM. BINGHAM & CO., Cleveland, Ohio

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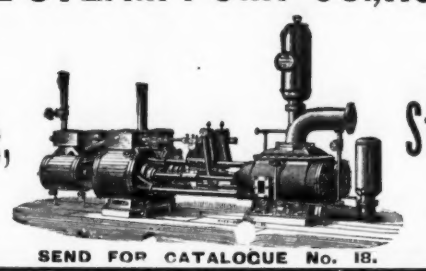
BUILD Water Works, ENGINES AND Steam Pumping MACHINERY.



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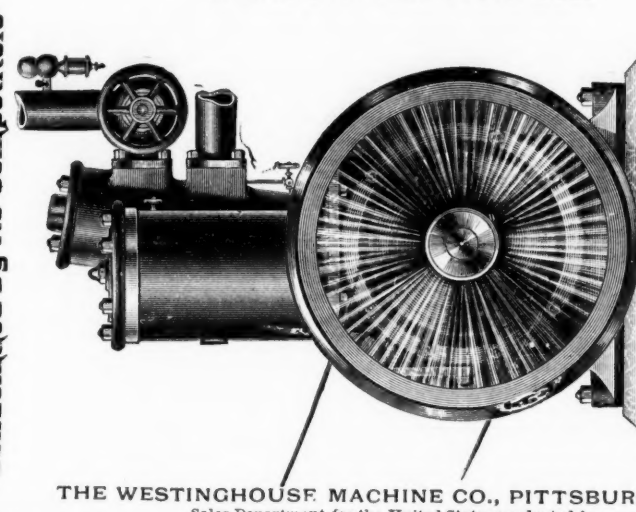

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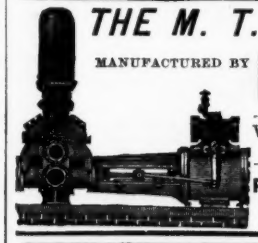

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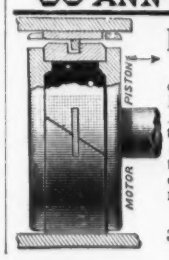

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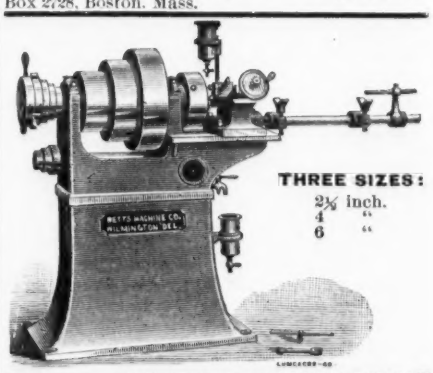

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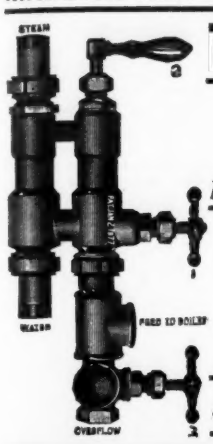

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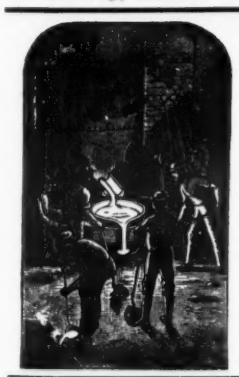

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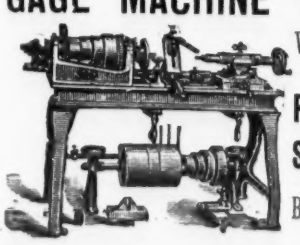

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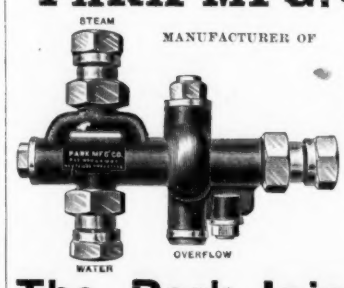

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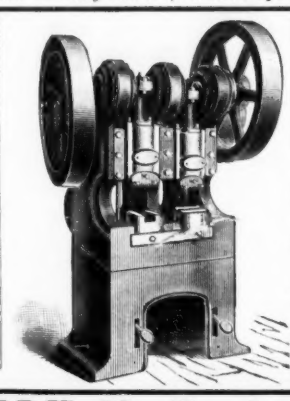

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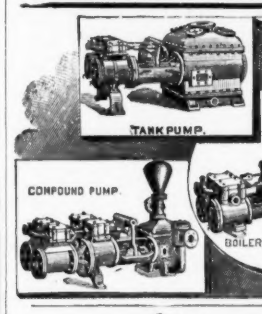

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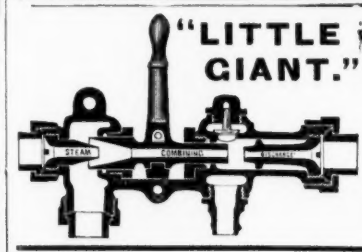

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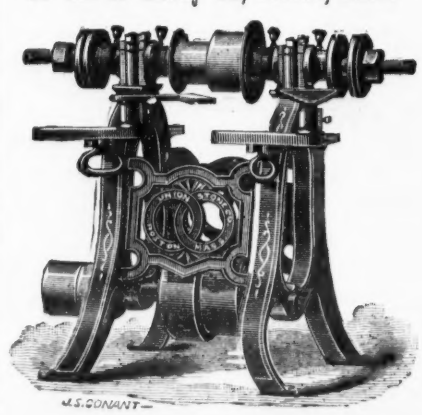

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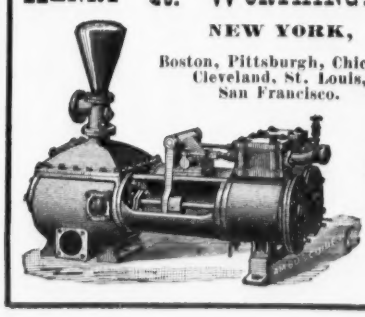

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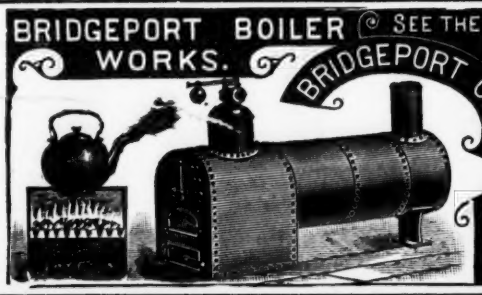

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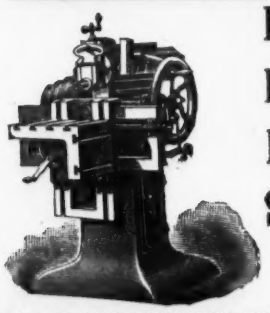
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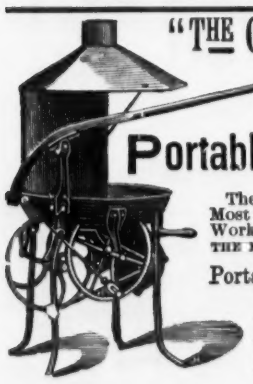
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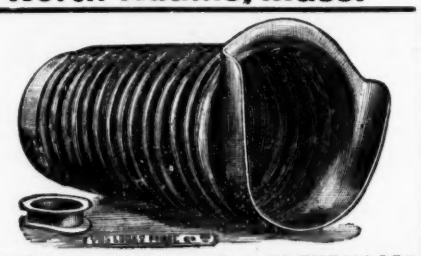
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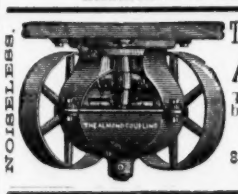

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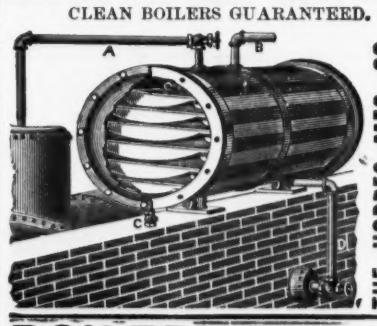

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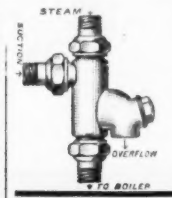

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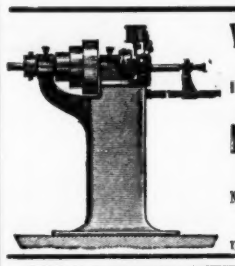
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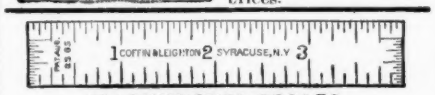

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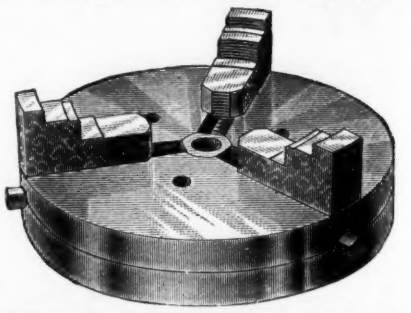
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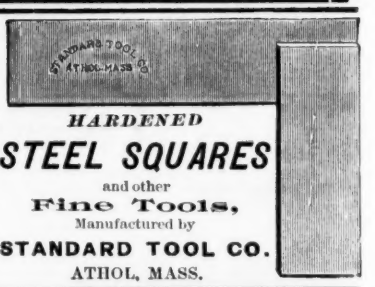

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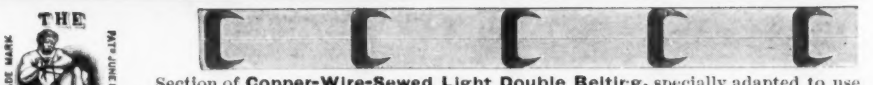

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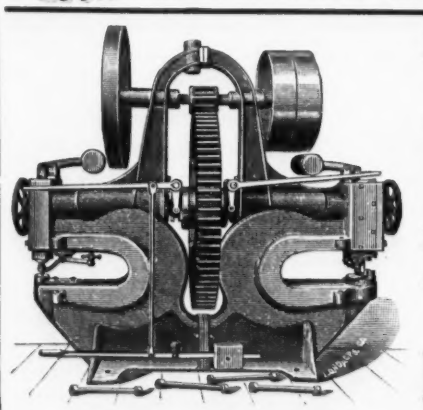
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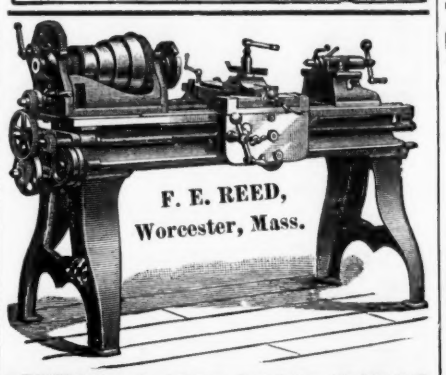

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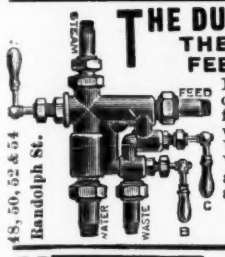

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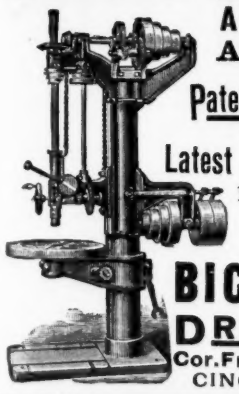

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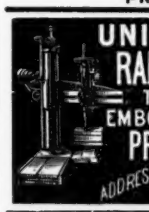

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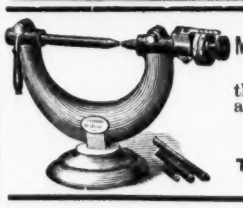

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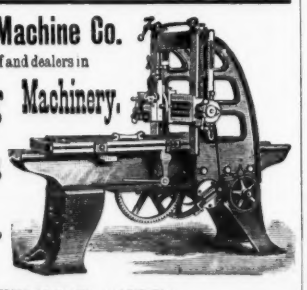

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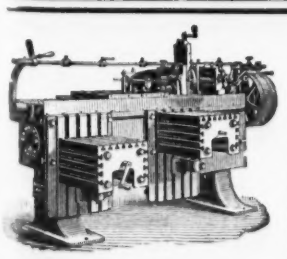

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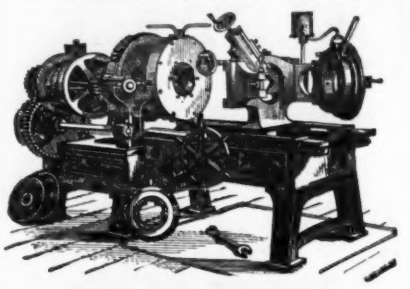

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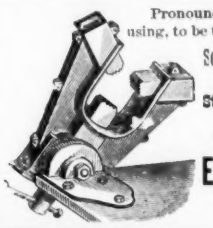

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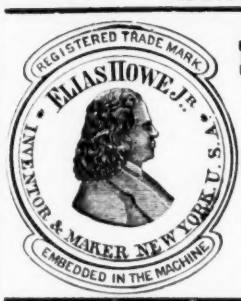

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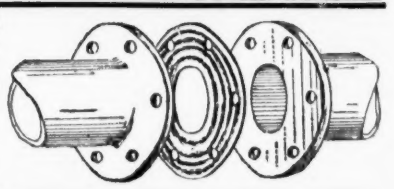

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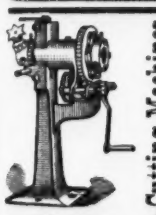

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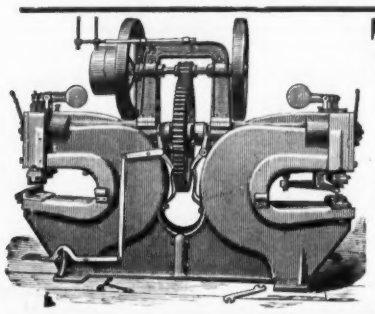

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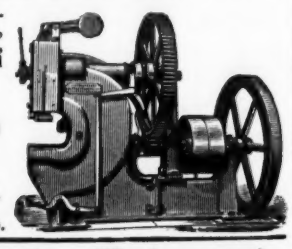

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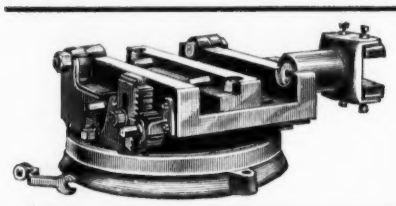

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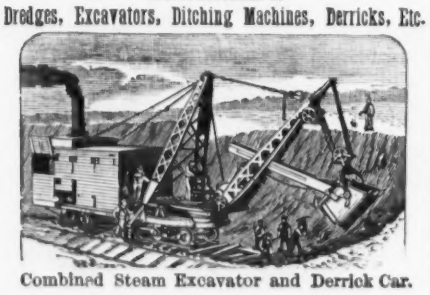

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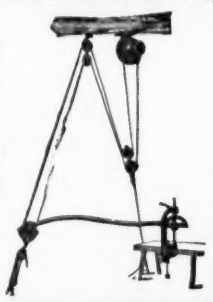

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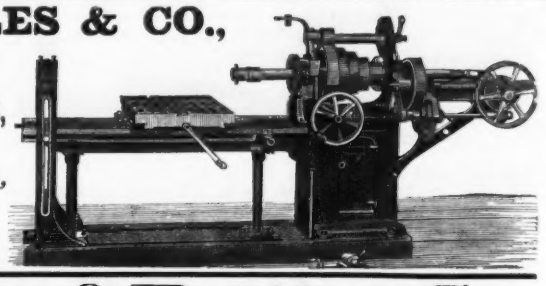

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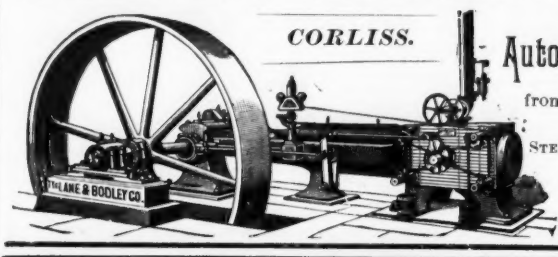

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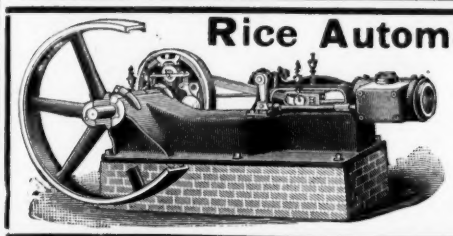

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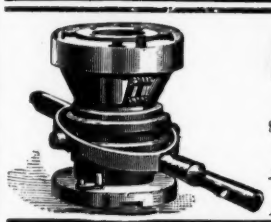

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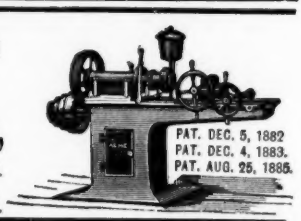

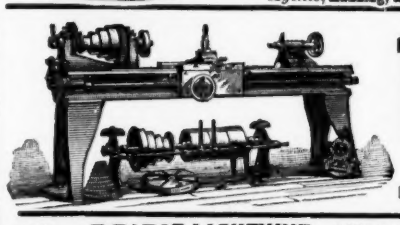

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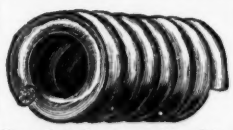

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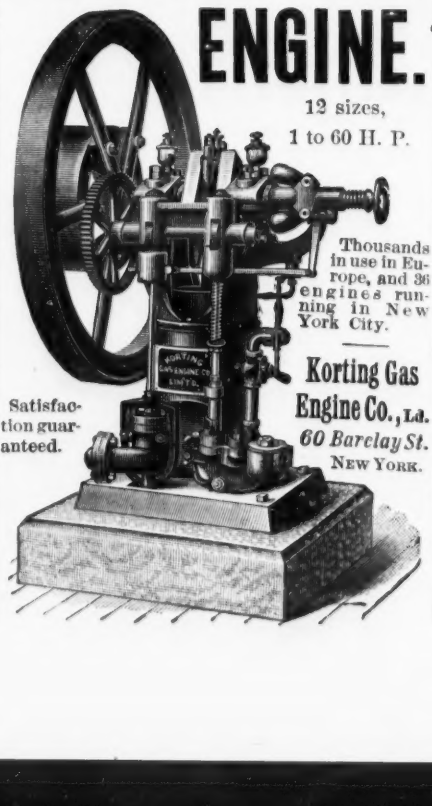

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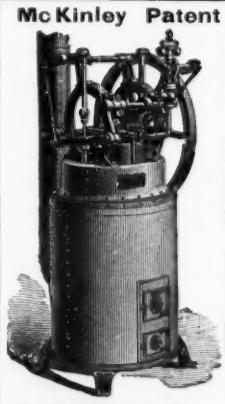

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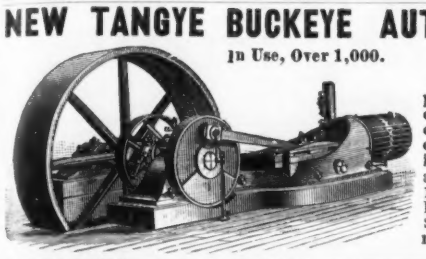

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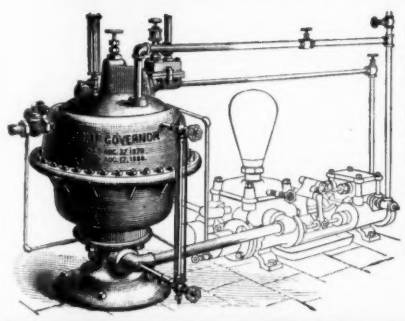

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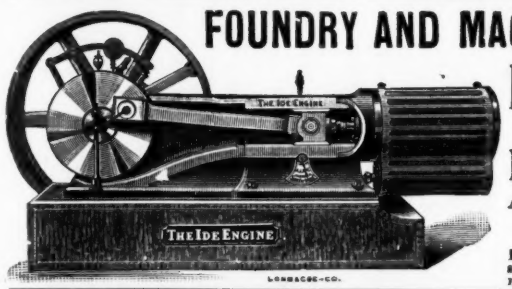

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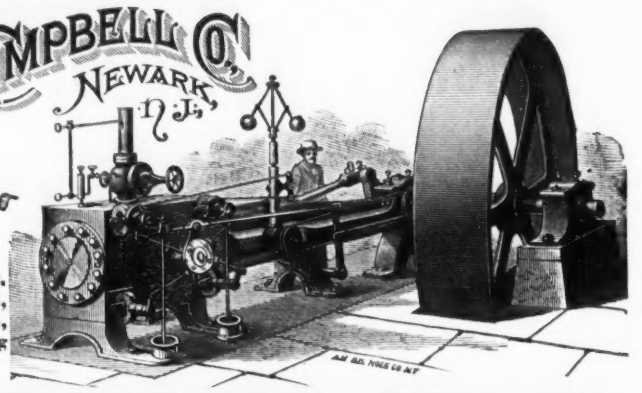

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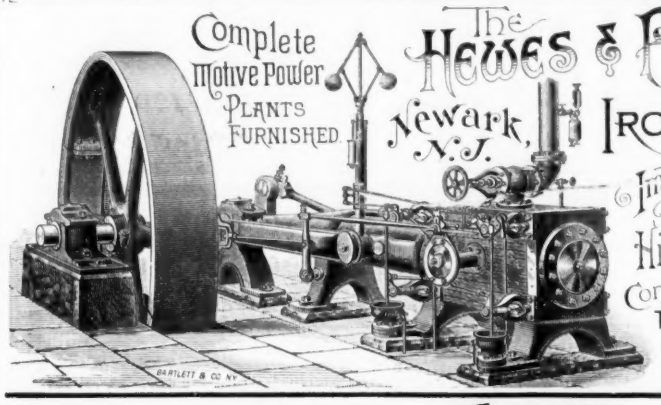

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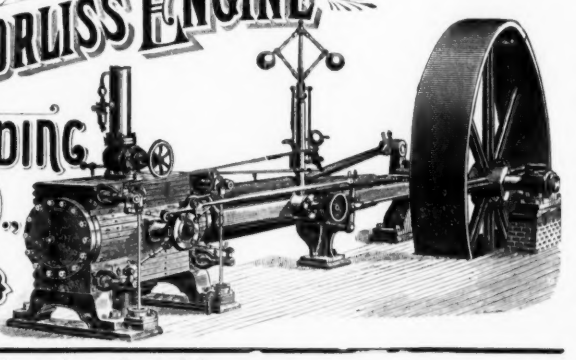

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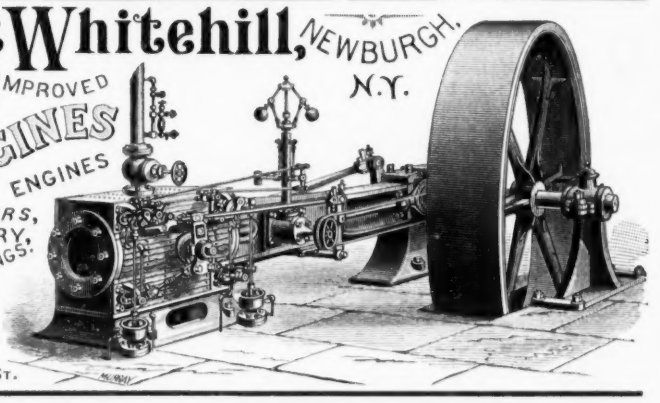

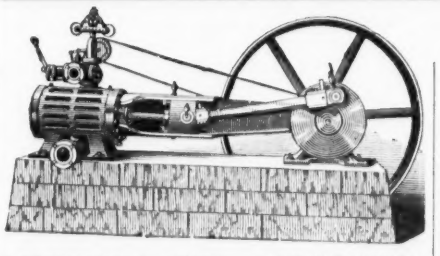

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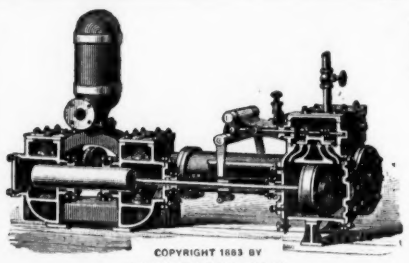

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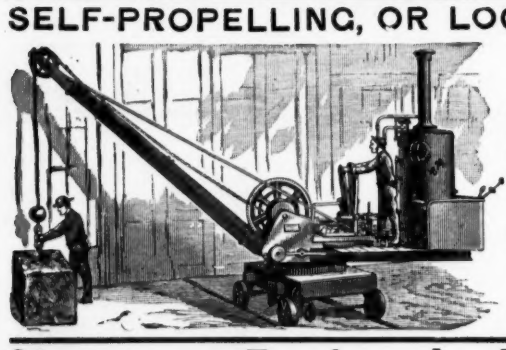

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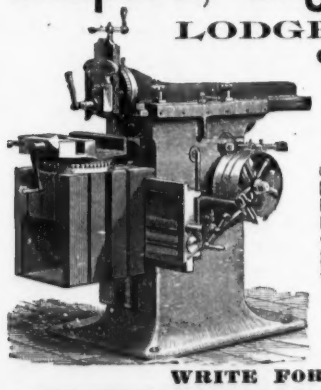

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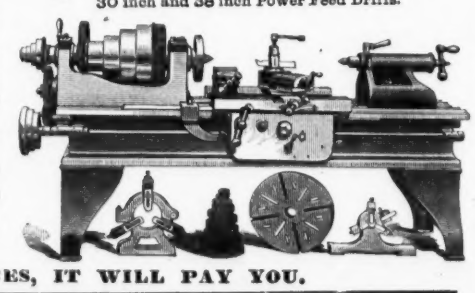

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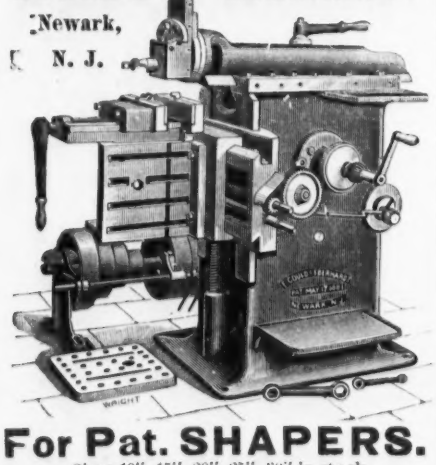

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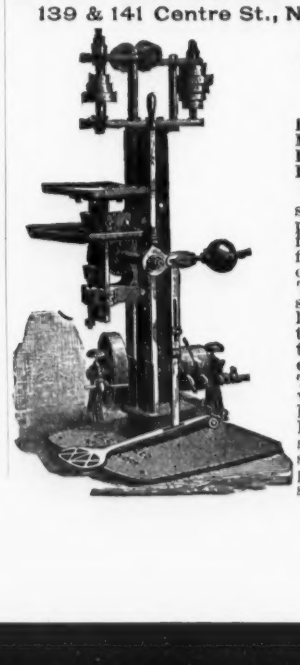

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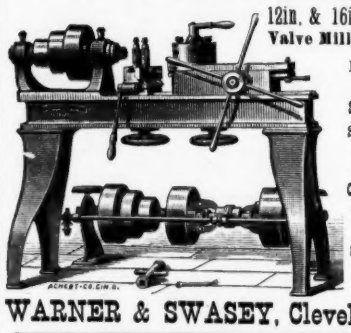

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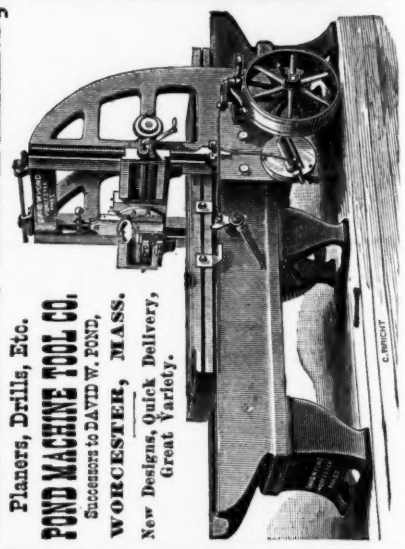

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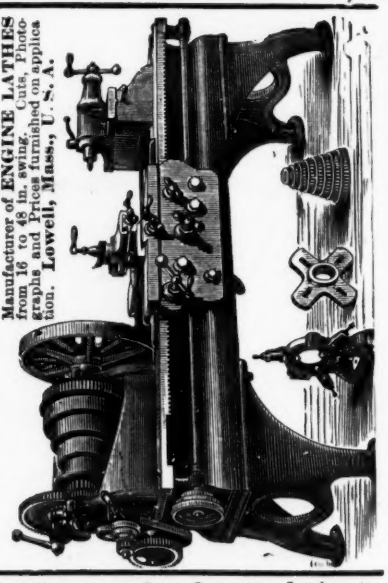

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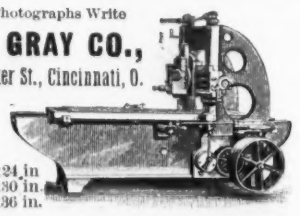

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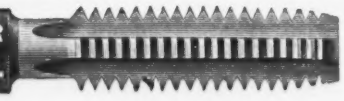

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